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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
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OFFICE OF

PREVENTION, PESTICIDES AND
TOXIC SUBSTANCES

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MEMORANDUM

SUBJECT: Review of Environmental Fate and Ecological Effects for the Re-Registration Eligibility Decision (RED) for Propanil.

TO: Tom Myers, PM Team Reviewer
Special Review and Reregistration Division (7508C)

FROM: Fred Jenkins, Fishery Biologist
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Fred 10/25/01
for Michele Mahoney 10/25/01
Abdel 10/25/01

THROUGH: Tom Bailey, Branch ~~Chief~~
Environmental Risk ~~Branch~~ II
Environmental Fate and Effects Division (7507C)

Tom A. Bailey 10/24/02

Attached is the Environmental Fate and Effects Division's (EFED) environmental and ecological risk assessment for the re-registration of propanil. Propanil is a postemergence herbicide used for the control of weeds in rice paddies, turf sod farms, and small grain (barley, oats, and spring wheat) fields. Approximately 99% of all propanil usage in the US is on rice crops, and 1% of propanil usage is on small grains. Currently, there is no evidence of any propanil usage on turf. EFED has determined that propanil use on rice at the maximum use rate may cause adverse ecological effects to birds, mammals, freshwater fish, freshwater invertebrates, and non-target terrestrial plants. The use of propanil on small grains may present risk to fish, aquatic invertebrates, birds, mammals, and nontarget plants. However, since the small grains uses are limited to 1% of total propanil usage in the US, EFED expects risks from these uses to be limited to localized regions relative to the larger risk expected from the larger use of propanil on rice. EFED also suspects that the major degradate of propanil, 3,4-dichloroaniline (3-4 DCA), may cause adverse effects to nontarget organisms.

The maximum estimated surface drinking water concentration for acute and chronic exposures are 489 ppb and 12.2 ppb, respectively. For groundwater drinking water sources, the estimated environmental concentrations (EECs) are expected to be <0.001 ppb.

For the major degradate 3,4-DCA, the maximum estimated surface water concentration for acute and chronic exposures are 1022 and 60 ppb, respectively. The EEC for groundwater sources is expected to be 0.35 ppb.

Outstanding Data Requirements

Table A lists the additional data requirements requested by EFED. This assessment will be incomplete until the data gaps are fulfilled.

Table A. Outstanding and Requested Data Requirements for Propanil

Guideline	*Study Name*	*Justification*
71-4a 71-4b	Avian reproduction studies on Propanil for mallard duck and bobwhite quail	EFED predicts that propanil's use on rice may cause chronic effects to birds because the level of concern is exceeded for chronic risks to mammals. Therefore, data are needed to assess the potential fo·· chronic risk to birds.
123-1 (Tier II)	Vegetative Vigor studies on Propanil TEP	The vegetative vigor study is invalid (MRID 43069901) because the method of application was inadequate; the chemical treatment solutions were more dilute than what is used under actual use conditions. An acceptable vegetative vigor study is still required.
122-1 (Tier I)	Seedling Emergence and Vegetative Vigor studies on the degradate 3,4-DCA	These studies should be conducted using the 5 most sensitive species identified in the respective studies using the parent compound. These studies are required for 3,4-DCA because it is longer-lived than the parent and the mode of action of the parent is herbicidal.

Table A. Outstanding and Requested Data Requirements for Propanil		
71-2	Acute Dietary Avian Test (Bobwhite quail) on major degradate of propanil 3,4 DCA	Available data indicates that 3,4 DCA is a major degradate of propanil. Non-guideline supplementary information, guideline studies suggest that major degradate ,3,4 DCA, may cause adverse effects to fish, mammals, and invertebrates (See Sec. II Environmental Risk Characterization). EFED needs to determine whether the degradate will adversely effect avian species.
71-4a 71-4b	Avian reproduction studies on 3,4 DCA for mallard duck and bobwhite quail	Non-guideline supplementary information, guideline studies suggest that major degradate ,3,4 DCA, may cause chronic adverse reproductive effects to fish and invertebrates (See Sec. II Environmental Risk Characterization). This may indicate reproductive effects may occur in other organisms such as avian species. Therefore, guideline studies are needed to adequately assess the potential effects of 3,4-DCA exposure to avian species.
72-1	Acute Fish Toxicity (Freshwater and Marine/Estuarine) Test on major degradate of propanil 3,4 DCA	Available data indicates that 3,4 DCA is a major degradate of propanil. Non-guideline supplementary information, guideline studies suggest that the major degradate ,3,4 DCA, may cause adverse effects to fish (See Sec. II Environmental Risk Characterization) EFED needs to determine whether the degradate will adversely effect fish species using guideline acute fish toxicity tests (72-1).
72-2	Acute Aquatic Invertebrate (Freshwater and Marine/Estuarine) Test on major degradate of propanil 3,4 DCA	Available data indicates that 3,4 DCA is a major degradate of propanil . Non-guideline supplementary information, guideline studies suggest that major degradate ,3,4 DCA, may cause adverse effects to invertebrates (See Sec. II Environmental Risk Characterization) EFED needs to determine whether the degradate will adversely effect invertebrate species using guideline acute invertebrate toxicity tests (72-2).

Table A. Outstanding and Requested Data Requirements for Propanil		
72-4 a	Freshwater and Marine Estuarine Fish Early Life-cycle Test on major degradate of propanil 3,4 DCA	Non-guideline supplementary information, guideline studies suggest that major degradate ,3,4 DCA, may cause chronic adverse effects to fish (See Sec. II Environmental Risk Characterization). Therefore guideline studies are needed to adequately assess the ecological effects of 3,4-DCA exposure.
72-4 b	Freshwater and Marine Estuarine Invertebrate Early Life-cycle Test on major degradate of propanil 3,4 DCA	Non-guideline supplementary information, guideline studies suggest that 3,4 DCA may cause chronic adverse effects to aquatic invertebrates (See Sec. II Environmental Risk Characterization). Therefore guideline studies are needed to adequately assess the ecological effects of 3,4-DCA exposure.
161-1	Hydrolysis Test on major degradate of propanil 3,4 DCA	Hydrolysis half-life is needed to determine the estimated environmental concentration of the degradate. The estimated environmental concentration will be used to determine the exposure to aquatic organisms and humans.
161-2	Aqueous Photolysis Test on major degradate of propanil 3,4 DCA	Photodegradation rate in water is needed to determine the estimated environmental concentration of the degradate. The estimated environmental concentration will be used to determine the exposure to aquatic organisms and humans.
163-1	Adsorption/Desorption Test on major degradate of propanil 3,4 DCA	Soil-water partition coefficient, Kd, is needed to determine the estimated environmental concentration of the degradate. The estimated environmental concentration will be used to determine the exposure to aquatic organisms and humans.

Recommendations for Label Language

Ecological Hazard Label Advisories

This pesticide is toxic to shrimp.

Surface Water Label Advisory

This product may contaminate water through runoff following rainfall events and by seepage through levees. This product has a high potential for runoff. Runoff of this product will be reduced by avoiding applications when rainfall is forecasted to occur within 48 hours. Levees should be constructed with adequate time prior to chemical application so that they are compacted to reduce seepage and to hold a 3-6 inch flood (2001 Mississippi Rice Growers Guide). Other guidance is located at http://agronomy.ucdavis.edu/uccerice/water/seep.htm and from the document "Closed Rice Water Management Systems" from the National Resource Conservation Service of USDA. The University of Arkansas Rice Production Book (http://www.uaex.edu/other_areas/publications/html) also provides information concerning levee production.

Ground Water Label Advisory

This chemical has properties and characteristics associated with chemicals detected in ground water. The use of this chemical prior to flooding may result in some shallow ground water contamination due to cracks in subsoil of the rice paddy.

Spray Drift Advisory

Do not allow this product to drift.

Toxicity of the degradate 3,4-DCA

Based on review of the open literature, EFED has determined that the major degradate of propanil, 3,4 DCA, may pose adverse risk to nontarget organisms. Studies show that 3,4-DCA exposure causes adverse reproductive effects in invertebrates. Adverse growth effects have been seen in fish due to 3,4-DCA exposure. Studies have also demonstrated that 3,4-DCA may cause toxic effects to the spleen and thymus of mammals. In addition, due to limited environmental fate data on 3,4-DCA, EFED is unable to sufficiently address the environmental fate of 3,4 DCA. In surface water monitoring studies, the concentration of 3,4-DCA did not exceed 26 ppb in surface water which is much lower than the concentration that caused adverse effects in fish. However, the monitored concentration is very similar to concentrations that caused adverse chronic effects in invertebrates.

Because EFED's concerns of risk to non-target organisms from exposure to 3,4 DCA are based on non-guideline supplementary information, guideline studies are needed to adequately assess the ecological effects of 3,4-DCA exposure.

Endangered Species

The Agency has developed the Endangered Species Protection Program to identify pesticides whose use may cause adverse impacts on endangered and threatened species, and to implement mitigation measures that address these impacts. The Endangered Species Act requires federal agencies to ensure that their actions are not likely to jeopardize listed species or adversely modify designated critical habitat. To analyze the potential of registered pesticide uses to affect any particular species, EPA puts basic toxicity and exposure data developed for REDs into context for individual listed species and their locations by evaluating important ecological parameters, pesticide use information, the geographic relationship between specific pesticides uses and species locations, and biological requirements and behavioral aspects of the particular species. This analysis will include consideration of the regulatory changes recommended in this RED. A determination that there is a likelihood of potential impact to a listed species may result in limitations on use of the pesticide, other measures to mitigate any potential impact, or consultations with the Fish and Wildlife Service and/or the National Marine Fisheries Service as necessary.

At present, the program is being implemented on an interim basis as described in a Federal Register notice (54 FR 27984-28008, July 3, 1989). A final program, which may be altered from the interim program, will be proposed in a Federal Register notice scheduled for publication in autumn of 2001.

EFED's Science Chapter on Propanil

by

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EFED's Science Chapter on Propanil
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Environmental Risk Conclusions

Based on the available data, propanil use on rice may cause adverse ecological effects when applied at the maximum application rate of 8 lbs. ai/A/yr. These expected risks are: 1) acute and chronic risk to freshwater fish and invertebrates including endangered species, 2) acute risks to birds including endangered species, 3) acute and chronic risk to mammals including endangered species 4) risk nontarget aquatic vascular and non-vascular plants including endangered species. Currently, EFED does not have valid data to determine the risks from propanil use on rice to terrestrial non-target plants. However, due to propanil's herbicidal mode of action, EFED assumes risks to nontarget terrestrial plants. In addition, there is one incident report of adverse effects to nontarget terrestrial plants as result of propanil usage on rice. The report concluded that aerial application of propanil to rice fields in Craighead, Arkansas, caused moderate to severe injury to trees located adjacent to the treated field.

The uses of propanil on small grains may present 1) an acute risks to birds, 2) an acute risk to mammals, 3) risk to aquatic vascular and nonvascular plants and endangered terrestrial plants in semi-aquatic areas, 4) chronic risk to freshwater fish including endangered species, and 5) an acute risk estuarine/marine invertebrates (risk include endangered species). However, since the small grain uses are limited to 1% of propanil usage in the US, EFED expects risks from these uses to be limited to localized regions relative to the larger risks expected from the larger use of propanil on rice.

Use of propanil on turf at the highest registered use rate may pose: 1) an acute and chronic risk to small mammals, 2) an acute risk to birds, 3) a risk to aquatic vascular and nonvascular plants and terrestrial plants in semi-aquatic and terrestrial areas including endangered species, and 4) acute and chronic risk to freshwater fish and invertebrate and 5) an acute risk to marine/estuarine fish and invertebrates (risk include endangered species). Although turf is a registered use, there is no evidence of any application of turf in the US.

EFED also suspects that the major degradate of propanil, 3,4-DCA, may cause adverse effects on nontarget organisms. In addition, EFED suspects that the major degradate of propanil, 3,4 DCA, may have an adverse effect on nontarget aquatic organisms. However, EFED's concerns about 3,4 DCA are based upon limited data. In order to adequately assess the risks of 3,4 DCA, more environmental fate and ecological toxicity data are needed.

The peak drinking water (surface water) concentrations for the Gulf Coast and California rice-growing regions are 236 and 0.7 ppb, respectively. Respective chronic concentrations (annual averages in Index Reservoir) are 5.9 and 0.02 ppb, respectively. The peak drinking water concentration (surface water) for the Mississippi Valley rice-growing region is 489 ppb. The chronic, annual average is 12.2 ppb. If the (normal) release is on day 78 (90 days from seeding), the peak is 0.65 ppb and the annual average 0.02 ppb. The maximum concentration of propanil (2.05 ppb) derived from monitoring data was lower than the modeled concentration for the Gulf Coast and the Mississippi Valley rice-growing regions. The estimated drinking water (ground water) exposure for propanil was < 0.006 ppb for both acute and chronic exposure (based on SCIGROW model). The maximum concentration of propanil (0.07 ppb) derived from monitoring data was 10 times higher than the modeled concentration.

The peak drinking water (surface water) concentrations of 3,4-DCA (propanil's major degradate) for the Gulf Coast and California rice-growing regions are 1007 and 106 ppb, respectively. Respective chronic concentrations (annual averages in Index Reservoir) are 59 and 6.2 ppb, respectively. The peak drinking water concentration (surface water) for the Mississippi Valley rice-growing region is 1022 ppb. The chronic, annual average is 60 ppb. If the (normal) release is on day 78 (90 days from seeding), the peak is 118 ppb and the annual average 6.9 ppb. The maximum concentration of 3,4-DCA (26.3 ppb) derived from monitoring data in Mississippi was lower than the modeled concentration for this rice-growing region.

I. Introduction

Propanil is a postemergence herbicide used for the control of weeds in rice paddies, turf sod farms, and small grains (barley, oats, and spring wheat). Rice is the predominant use of propanil in the US (99% of usage in the US).

Application Rates and Methods

Table 1 summarizes the propanil uses supported for re-registration, including application rates and methods.

Table 1. Maximum labeled application rates and methods for propanil

End-uses	Application Methods	Max. Label Rates (lbs ai/A)	Seasonal Max. Rate (lb ai/A)
Agricultural			
rice	A/G	4	8
spring wheat, oats, barley	A/G	2.3	2.3
Non-Agricultural			
turf for sod	A/G	10	10

A = Aerial, G = Ground

A. Use Characterization

The majority of propanil use (99% of use in US) is for weed control in rice. There are three major rice growing regions in the United States in which propanil is used. The regions include: 1) the Gulf Coast of Louisiana and Texas, 2) the Mississippi Valley including parts of northern Louisiana, Mississippi, Arkansas, and southern Missouri, 3) and California in the Sacramento River Basin. The maximum use rate for propanil in the U.S. is two applications at 4 lbs. ai per acre. There are different management practices for growing rice and using propanil in each of the regions (see

Appendix E for explanation of the practices for each region).

Propanil use on spring wheat, oats and barley is restricted to the following states: Minnesota, Montana, North Dakota, and South Dakota. The maximum use rate for use of propanil to control weeds in small grain crops is a single application at 2.3 lbs ai/A.

Propanil is also labeled for use on turf (sod farms). However, currently there is no evidence of any turf usage of propanil in the US (based on consultation with the Special Registration and Review Division of EPA). The maximum registered use rate on turf is 10 lb ai/A/year.

B. Formulation Information

The manufacturing-use products of propanil are formulated as 85%, 90%, and 96% ai. (Technical). The End-Use products are formulated as: 1) an emulsifiable concentrate with 33, 33.8, 35, and 35.9% ai (3 lb ai/gal), 2) an emulsifiable concentrate with 43.48, 43.5, 44.5, 45, and 45.4% ai (4 lb ai/gal), and 3) a soluble concentrate/liquid 35 % ai (3 lb ai/gal).

C. Mode of Action

Propanil is a post-emergence herbicide used that controls many grasses and broadleaf weeds in rice fields, and when tank mixed with MCPA, on small grains. This chemical kills susceptible weeds by direct contact; thorough spray coverage is required for best results. The proper stage of growth for application is 1- to 3- leaf stage (weeds). Propanil inhibits photosynthesis by binding to a protein at the lipophilic binding niche for a protein-bound plastoquinone (Q_B). This protein is called the D-1 protein. Propanil competes with Q_B for the binding niche in the D-1 protein. This competition can lead to displacement of the Q_B, thus stopping electron flow through one of the light reaction of photosynthesis called photo system II (PS II). In addition, the residence time of herbicide in the binding niche is known to be greater than Q_B, thus increasing the inhibitory action of this molecule.

D. Chemical and Physical Properties

Common Name: propanil

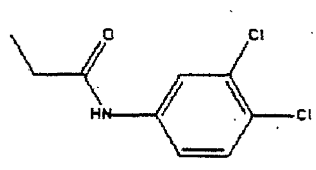
Trade Name(s): STAM, LATRON

Chemical Name: 3,4-dichloropropionanilide, or N-(3,4-dichlorophenyl) prpanamide.

Chemical Abstract Registry No.: 709-98-8

Type of Product: Herbicide

Chemical Structure:



Molecular weight: 218

Aqueous Solubility (at 25°C): 225 ppm.

Vapor Pressure: 4×10^{-5} mmHg (at 30°C)

Henry's Law Constant: $1.15E^{-7}$ atm-m^3/mol (measured).

II. Environmental Risk Characterization

Propanil has three registered uses: rice, small grains, and turf. Approximately 99% of propanil is used on rice and 1% is used on small grains. Currently, there is no evidence of any application to turf. The following paragraphs describe the risk associated with these uses. The risk characterization is intended to describe the magnitude of the estimated environmental risks and uncertainties of the risks associated with the uses.

Rice Risk Characterization

The risk characterization is intended to describe the magnitude of the estimated environmental risks and uncertainties of the risks associated with the use of propanil on rice. This risk characterization discusses all of the following risks posed by propanil's use on rice: 1) acute and chronic risks to mammals, 2) acute risks to birds, 3) acute and chronic risks to freshwater fish and invertebrate, 4) potential risk to non-target plants and 5) potential risks of major degradate of propanil, 3,4 dichloroaniline (3,4 DCA).

The risk quotients (RQs) indicate that the level of concern (LOC) is exceeded for acute risk to birds (See Sec. V. Rice Use: Terrestrial Hazard, Exposure, and Risk Summary for Birds and Mammals). EFED predicts that this risk is likely because rice paddies provide the habitat and abundant food resources for various avian species. Rice growing regions in the United States are crucial over-wintering areas for millions of waterfowl and shorebirds of the Central, Mississippi and Pacific flyways. Each year migratory ducks, geese and shorebirds visit rice fields to feed and build strength for their return to northern nesting grounds. In addition, rice paddies in the US are managed as artificial wetlands in order to provide habitat for various avian species. Rice paddies managed as artificial wetland habitats help to replace natural wetland habitats which have been depleted by a rising sea level, subsidence, salt water intrusion through navigation channels, and reduction in the volume of river born sediment. EFED predicts acute exposure to avian species from expected environmental residues of propanil on food items from the use of propanil on rice (See Table 10 for expected environmental residues of propanil on food items).

Currently, avian chronic toxicity tests have not been submitted to EFED. However EFED suspects that propanil may cause effects to birds because mammalian toxicity data indicate that the use of propanil on rice exceeds the level of concern for chronic risk to mammals. However, because no avian chronic toxicity data have been submitted, EFED is uncertain of the chronic risks of propanil to avian species.

In addition to chronic risk to mammals, the LOC is also exceeded for acute risks to mammals (see Sec. V. Rice Use: Terrestrial Hazard, Exposure, and Risk Summary for Birds and Mammals). EFED predicts that this risk is probable because rice fields also provide a habitat rich in food sources for various mammal species. EFED predicts exposure to mammals from expected environmental residues of propanil on food items from the use of propanil on rice (See Table 10 for expected environmental residues of propanil on food items)

EFED assessed the risk of propanil to fish and aquatic invertebrate which inhabit both the treated rice paddies and areas adjacent to the rice paddy. The level of concern for acute and chronic risk is exceeded for fish and invertebrates that inhabit the treated rice paddies (See Section IV. Rice Use: Aquatic Hazard, Exposure, and Risk Assessment). EFED predicts that this risk is likely because various freshwater invertebrate species and some fish species inhabit rice paddies during the growing season. Small fishes and aquatic invertebrates are important components of the rice paddy ecosystem because they provide food resources for various avian species. Crayfish are commonly commercially raised in rice paddies during the rice growing season. EFED predicts that the propanil use on rice at the maximum use rate may pose a risk to commercial crayfish populations. Available data indicate that propanil is not expected to persist in the environment, thus eliminating chronic exposure to freshwater fish and invertebrates. However, organisms may suffer from chronic and acute effects upon acute exposure to a chemical. Therefore, EFED predicts that acute exposure to propanil may cause acute and chronic effects to freshwater invertebrates.

The assessment on fish and aquatic invertebrate which inhabit areas adjacent to the rice paddy indicated that the level of concern for risk was not exceeded. EFED predicts this conclusion is accurate because concentrations of propanil are expected to be significantly lower than concentration predicted in the treated rice paddy (See Section IV. Rice Use: Aquatic Hazard, Exposure, and Risk Assessment).

Although valid non-target plant toxicity data is not available, EFED assumes risks to non-target plants from propanil use on rice. This conclusion is based on the premise that the herbicidal mode of action of propanil may have adverse effects on nontarget plants. This conclusion is also supported by a reported incident of nontarget plant damage caused by spray drift following propanil use on rice in Craighead, Arkansas. The incident involved damaged shade trees which were adjacent to a 150 acre rice paddy. Shortly after application of propanil to the rice paddy the shade trees showed moderate to severe injury in their leaves. Symptoms included burnt and shedding leaves and lack of new growth on older trees. An analysis was not conducted, but due to the proximity of the aerial propanil application near the trees, the official report ruled that propanil spray drift was likely the cause of the tree injury.

Although this incident demonstrates that spray drift may present significant route of exposure to nontarget plants, the spray drift of propanil may be dependant upon the formulation type. Sanderson (1997) demonstrated that the formulations containing a non-ionic surfactant decrease the droplet size of propanil during application. This reduction in droplet size consequently may increase the spray drift potential.

EFED has determined that the major degradate of propanil, 3,4 DCA, may pose adverse risk to nontarget organisms. A study by Barrata and Baird (2000) demonstrated reproductive effects on egg and adult stages of *Daphnia magna* exposed to 3,4 DCA (LC_{50} = 14 ppb). Ferrando (1992) found propanil caused acute toxic effects at 24 hrs. to *Daphnia magna* and *Brachionus calyciflorus* (LC50 0.20 ppm and 61.5 ppm respectively). Taylor (1994) determined that 3,4 DCA significantly affected the growth of *Gammarus pulex (L.)* and *Chironomus riparius Meigen*. The no-observed-effect concentrations (NOECs) obtained in the tests were 0.08 mg DCA liter-1 (G. pulex) and 0.76 mg DCA liter-1 (C. riparius). Guilhermino 1998, found acute effects from 3,4 DCA in the spleen and thymus of rats at a lowest observed effect level value of 324 mgDCA/Kg. Because EFED's risk concerns from exposure to 3,4 DCA are based on non-guideline supplementary information, guideline toxicity studies are needed to adequately assess the ecological effects (See Table A. Outstanding and Requested Data Requirements for Propanil pg. 2).

In addition, due to limited environmental fate data on 3,4-DCA, EFED is unable to sufficiently assess its environmental fate and transport. However, EFED has received surface water monitoring data that demonstrate the tendency for 3,4 DCA to leave fields treated with propanil and diuron. Overall concentrations ranged from below the detection limit of 0.05 ppb to 26 ppb, with the majority of the sample detections being <1 ppb. 3,4-DCA was detected in these regions year-round; higher concentrations were generally associated with the use period. EFED suspects that the primary source of the 3,4 DCA detections was from propanil use because 3,4 DCA, is the primary degradation product of propanil. Furthermore, 3,4 DCA is only a minor degradate of diuron. Although the monitoring data indicates 3,4 DCA concentrations in surface water may occur from propanil use, EFED needs guideline environmental fate and transport data in order to assess the potential risk of 3,4 DCA to nontarget organisms.

Risk Characterization of Small Grain and Turf Uses

The uses of propanil on small grains may also present 1) an acute risks to birds, 2) an acute risk to mammals, 3) risk to aquatic vascular plants and terrestrial plants in semiaquatic areas, 4) chronic risk to freshwater fish, and 5) an acute risk to estuarine/marine invertebrates. There are several LOC exceedances, however the small grain uses are limited to 1% of propanil usage in the US. Therefore, EFED expects risks from these uses to be limited to localized regions (Minnesota, Montana, North Dakota, and South Dakota) relative to the greater risks expected from the larger use of propanil on rice.

Propanil's use on turf at the highest registered use rate may pose: 1) an acute and chronic risk to small mammals, 2) an acute risk to birds, 3) a risk to aquatic vascular and nonvascular plants and terrestrial plants in semi-aquatic areas; and 4)acute risk to freshwater and marine/estuarine fish and invertebrates. Although turf is a registered use, currently there is no evidence of any applications to turf in the US. Therefore, because of the lack of propanil use on turf, EFED expects risks to nontarget organisms to be less than the risks associated with the predominant rice usage of propanil in the US.

Summary of Propanil Risk Characterization

Amongst the registered uses of propanil, rice is expected to present the largest ecological risk in the US. Since the small grains uses do not exceed 1% of total propanil usage in the US, EFED expects ecological risks from these uses to be localized. EFED also suspects that the major degradate of propanil, 3,4-DCA, may cause adverse effects to nontarget organisms. However, EFED's risk concerns from exposure to 3,4 DCA are based on limited data. Therefore, guideline studies are needed to adequately assess the ecological effects.

III. Environmental Fate and Transport Assessment

A. Summary

Available data indicates that propanil will not persist in the field. Based on acceptable studies, propanil is rapidly metabolized under aerobic or anaerobic conditions in a water/sediment milieu (laboratory $t_{1/2}$ = 2-3 days). Acceptable aquatic field dissipation studies in rice paddies at two sites indicate short half-lives for propanil in the water (undetectable after no more than one day) and in the soil (sediment detections were near the quantitation limit, 0.01 ppm, by 2-7 days). The principle metabolic degradate, 3,4-DCA, reached a peak value (2.7 ppm) in soil (sediment) at 1 to 5 days after the second of two applications, remained high for 1 to 2 weeks, and was near detection limits, 0.01 ppm, for 4-6 months. Propanil metabolized rapidly in aerobic soil with a half-life of 0.5 days. However, propanil is stable to hydrolysis at pHs 5, 7, and 9 in the laboratory and, based on marginally acceptable study, propanil is stable to unsensitized aqueous photolysis. A supplemental soil photolysis study also suggests that propanil is stable to photodegradation, and the observed transformation was due mainly to metabolic activity. Propanil is susceptible to biodegradation, yet stable to chemical degradative processes.

The available mobility studies (K_{oc} values) indicate that propanil is in the medium mobility class for sand, sandy loam, and clay loam soils, and has low mobility in silty clay loam and silt loam soils (ASTM, 1996). The partition coefficient (K_d) for propanil ranges from 0.538 (sand) to 11 (clay loam), and K_{oc} values ranged from 306 (sand) to 800 (silt loam), respectively.

Acceptable aquatic field dissipation studies also indicate that propanil and 3,4-DCA are associated generally with the sediment rather than the aqueous phase. Detectable residues are confined largely to the top 2 inches of the sediment.

Based on mobility criteria detailed above (highly soluble, medium K_{oc} and K_d values), propanil could possibly reach groundwater but due to its rapid metabolism in a water/soil matrix, it is not likely to persist for a significant amount of time to leach in measurable quantities. The possible exception are sites of extreme vulnerability and low metabolic capacity which would most probably occur only for terrestrial uses. If propanil does reach groundwater in these vulnerable areas, it is expected to be stable [in groundwater].

The major degradate of propanil is 3,4 dichloroaniline, 3,4-DCA. In MS, MO, TN, AR, and North LA, 3,4-DCA was detected with extremely high frequency in surface water (96.2% of 346 samples) but did not exceed 26 ppb (Harris, 2001). Overall concentrations ranged from below the detection limit of 0.05 ppb to 26 ppb, with the majority of the sample detections being <1 ppb. Note that 3,4-DCA was detected in these regions year-round; higher concentrations were generally associated with the use period. In South Louisiana, there were only three samples analyzed for 3,4-DCA, with concentrations ranging from 0.01-0.06 ppb (Walters, 2001). DCA detections in MS, MO, TN, AR, and North LA is likely to be a result of both diuron and propanil applications for cotton and rice production since 3,4-DCA is a common degradate of these pesticides. In addition, industrial uses may contribute to environmental concentrations. In South Louisiana, the three 3,4-DCA detections occurred in the suburban area of E. Baton Rouge Parish. EFED notes that diuron was also detected in the three aforementioned samples and, therefore, the presence of DCA in this area is most likely due to roadside use of diuron.

The proposed degradation pathway of propanil in aerobic soil is presented in Appendix C.

B. Drinking Water Assessment

a. Modeling Data (Drinking Water Recommendation)

The Environmental Fate and Effects Division does not have an officially approved model to predict concentrations of pesticides in rice paddy water. The approach taken here was based on a hypothetical rice paddy, 1 hectare in size, flooded to a depth of 10 cm, with a sediment interaction zone of 1cm. This screening calculation method models drinking water concentrations for the primary rice growing regions (California, Gulf Coast, and Mississippi Valley; See Appendix E for model assumptions and inputs). The peak DW concentration is the concentration in the paddy on the day of release (day 78 in CA, day 28 for the Gulf Coast, day 43 in the MS Valley) divided by two, since the volume of the reservoir and the volume of the paddies are assumed to be roughly equal. A chronic concentration was obtained by decaying the peak concentration for a year at the aerobic aquatic rate, and taking the average over 365 days. Tables 2 and 3 illustrate the surface drinking water EECs for propanil and 3,4-DCA, respectively.

Table 2. Modeled EECs (ppb) of Propanil in Surface **DRINKING** Water from two applications to three different rice-growing scenarios.		
Scenario	**Acute (peak)**	**Chronic**
California	0.7	0.02
Gulf Coast	236	5.9
Mississippi Valley (flooded release; day 21)[1]	489	12.2
Mississippi Valley (normal release; day 78)[1]	0.65	0.02

1 The peak concentration represents pre-mature release of the paddy water due to rainfall. If overflow does not occur and the (normal) release occurs on day 78 (90 days after seeding), the peak is 0.65 ppb and the annual average is 0.05 ppb.

Table 3. Modeled EECs (ppb) of 3,4-DCA in SURFACE Drinking Water from two applications of propanil to three different rice-growing scenarios.		
Scenario	**Acute (peak)**	**Chronic**
California	106	6.2
Gulf Coast	1007	59
Mississippi Valley (overflow release)[1]	1022	60
Mississippi Valley (normal release)	118	6.9

1 The peak concentration represents pre-mature release of the paddy water due to rainfall.

SCI-GROW estimates were calculated to determine ground water concentrations according to the method described in Barrett, 1997. SCIGROW is a screening model for ground water (See Appendix E for model inputs). It is based on a regression approach which relates the concentrations found in ground water in prospective ground water studies to aerobic soil metabolism rate and soil-water partitioning properties of the chemical. Table 1 illustrates the ground water EECs.

Table 4.	Estimated environmental concentrations (ppb) recommendations for propanil and 3,4-DCA in GROUND drinking water from rice use.

	propanil	3,4-DCA
Groundwater - drinking water risk assessment	≤0.001	0.35

b. Monitoring Data

1) *Surface Water*

The USGS reported that for 62 agricultural streams sampled as part of NAWQA studies (1992-1996) by its National Water-Quality Assessment (NAWQA) program, that propanil was detected in only 2.56% of the 1560 water samples analyzed with a maximum concentration of 2.05 ppb. The frequency of sampling and the length of sampling period were not sufficient temporally and spatially to estimate potential drinking water concentrations for regulatory purposes. Therefore, the ambient and drinking water assessments are based on the environmental models described in the preceding section.

3,4-DCA is a common degradate for propanil, diuron, and linuron. A USGS study which analyzed 346 water samples collected in MS, MO, TN, AR, and North LA (mostly creeks, bayous and rivers) from February 1996-February 2001 (sampling every 2 weeks to monthly) showed that 3,4-DCA was detected with extremely high frequency in surface water (96.2% of 346 samples) but did not exceed 26 ppb (Harris, 2001). Overall concentrations ranged from below the detection limit of 0.05 ppb to 26 ppb, with the majority of the sample detections being <1 ppb. Note that 3,4-DCA was detected in these regions year-round; higher concentrations were generally associated with the use period. In South Louisiana, there were only three samples analyzed for 3,4-DCA, with concentrations ranging from 0.01-0.06 ppb (Walters, 2001). DCA detections in MS, MO, TN, AR, and North LA is likely to be a result of both diuron and propanil applications for cotton and rice production. In addition, industrial uses may contribute to environmental concentrations. In South Louisiana, the three 3,4-DCA detections occurred in the suburban area of E. Baton Rouge Parish. EFED notes that diuron was also detected in the three aforementioned samples and, therefore, the presence of DCA in this area is most likely due to roadside use of diuron.

2) *Ground Water*

EFED has limited monitoring data on the concentrations of propanil in groundwater. Even though the groundwater monitoring data collected by USGS (NAWQA) are from sites considered to be typical use areas, the frequency of sampling and the length of sampling period were not sufficient temporally and spatially to determine drinking water concentrations for regulatory purposes. Validated monitoring data for propanil for the states of California, Arkansas, Missouri, and Mississippi show that propanil was detected only in two wells out of a total of 124 in Missouri. The detected concentrations were 0.06 and 0.07 ppb, which are 10 times greater than the concentrations predicted using the SCI-GROW model.

In addition, the US Geological Survey (USGS) National Water Quality Assessment Program (NAWQA) analyzed pesticide occurrence and concentrations for major aquifers and shallow ground water in agricultural areas. Samples (total 933) collected from major aquifers did not contain propanil at levels above the detection limit (0.05 ppb). Maximum propanil concentration in 301 samples from shallow groundwater sites was 0.008 ppb, which is equivalent to the concentrations predicted using the SCI-GROW model.

The major component of the sampling design in the NAWQA study was to target specific watersheds and shallow ground water areas that are influenced primarily by a single dominant land use (agricultural or urban) that is important in the particular area. The ground water data were primarily collected from a combination of production and monitoring wells. Groundwater sites in the groundwater data were sampled for pesticides from a single snap-shot in time.

The SCIGROW model was used to estimate potential groundwater concentrations. The SCIGROW EECs for propanil were $\leq$0.001 ppb. The SCIGROW modeling results indicate that both propanil and 3,4-DCA will not be found in high concentrations in groundwater. Propanil concentrations are under-predicted by the model, however, the differences from monitored numbers are within acceptable variances. Since there is limited fate data for 3,4-DCA, EFED can not confirm that modeling and monitoring data are supportive of each other.

c. Spray Drift Management

The Agency has been working with the Spray Drift Task Force, EPA Regional Offices and State Lead Agencies for pesticide regulation and other parties to develop the best spray drift management practices. The Agency is proposing interim mitigation measures for aerial applications that should be placed on product labels/labeling as specified in section V of this document. The Agency has completed its evaluation of the new data base submitted by the Spray Drift Task Force, a membership of U.S. pesticide registrants, and is developing a policy on how to appropriately apply the data and the AgDRIFT computer model to its risk assessments for pesticides applied by air, orchard airblast and ground hydraulic methods. After the policy is in place, the Agency may impose further refinements in spray drift management practices to reduce off-target drift and risks associated with aerial as well as other application types where appropriate. In the interim, labels should be amended to include the following spray drift related language:

For products that are applied outdoors in liquid sprays (except mosquito adulticides), regardless of application method, the following must be added to the labels:

"Do not allow this product to drift"

For outdoor liquid or granular products that are applied aerially, further label language is necessary for spray drift management.

IV. Rice Use: Aquatic Hazard, Exposure, and Risk Assessment

A. Hazard Summary

Propanil is categorized as slightly to moderately toxic to freshwater fish and moderately toxic to freshwater invertebrates. In addition propanil is moderately toxic to estuarine/marine fish and moderately toxic to highly toxic to estuarine/marine invertebrates (Appendix H, Tables 4-9).

B. Aquatic Exposure Summary

The Environmental Fate and Effects Division currently does not have a standard model for estimating pesticide EECs in rice paddy water. The approach taken here was based on a hypothetical rice paddy, 1 hectare in size, flooded to a depth of 10 cm, with a sediment interaction zone of 1 cm. This screening calculation method models concentrations for the primary rice growing regions (California, Gulf Coast, and Mississippi Valley; See Appendix E for model assumptions and inputs). The risk qoutients (RQs) were based upon the highest EECs (wet-seeded rice growing-regions - Gulf Coast and California) amongst the rice scenario regions (Table 5).

Table 5. Modeled EECs (ppb) of Propanil for AQUATIC Exposure from two applications to three different rice-growing scenarios. The EECs were calculated immediately following the second application.

Cultural Practice	Maximum	4-Day	21-Day	56-Day
Wet-seeded Rice (CA & Gulf Coast regions)[1]	1062	854	407	169
Dry-seeded Rice	977	785	374	156

Table 6. Modeled EECs of Propanil (ppb) at the time of flood release (90 days after planting) for AQUATIC Exposure. The EECs were calculated using the concentration of the parent at the time of release (1.4 ppb for both wet- and dry- seeded rice).

Cultural Practice	Maximum	4-Day	21-Day	56-Day
Wet- and Dry-seeded Rice	1.4	1.1	0.5	0.2

C. Risk Assessment Summary

Risks to aquatic organisms (including freshwater and marine/estuarine fish and invertebrate and aquatic vascular and nonvascular plants) are calculated by using RQs (Tables 7-9). The RQs for aquatic organisms are a function of the EECs (Tables 5-6), and the most sensitive toxicity endpoints for freshwater and marine/estuarine aquatic organisms (Appendix H, Tables 4-9). The EECs used to calculate RQs represent the expected concentration of propanil from rice use in the Gulf Coast region (expected to be the highest EECs amoungst the primary rice growing regions). In addition, the EECs represent the maximum concentrations of propanil in the rice paddy immediately following the second application and concentrations expected at the time of flood release (Tables 5 and 6, respectively).

a. Risk to Freshwater Fish and Invertebrates

Risk quotients were calculated based on exposure concentrations of propanil in the rice paddy immediately following the second application and concentrations expected at the time of flood release (Tables 5-6). The RQs which are based on exposure concentration immediately after the second application are used to assess the risk to aquatic invertebrates and fish which inhabit the rice paddies. The RQs based on exposure in the paddy water at the time of flood release was used to assess risk to freshwater fish and invertebrate inhabiting areas adjacent to the rice paddies.

The risk quotients in Table 6 indicate that the level of concern (LOC) is exceeded on an acute and chronic basis for freshwater fish and invertebrates which inhabit the rice paddies (risks include endangered species). For the estimated exposure concentration at the time of normal paddy flood water release, the risk quotients indicate that the LOCs are not exceeded for freshwater fish or invertebrates inhabiting areas adjacent to the paddy.

Table 7. Toxicity Values and Risk Quotients for Freshwater Fish and Invertebrates.

Exposure Conditions	Organism	Exposure Type	Most Sensitive Species (Surrogate)	Toxicity	EEC	Risk Quotient (EEC/Toxicity)
At the time of normal paddy flood water release.	Freshwater Fish	Acute	Rainbow Trout	LC_{50}= 2300 ppb	1.4	<0.05
	Freshwater Invertebrate	Acute	Daphnia magna	EC_{50}= 1200 ppb	1.4	<0.05
	Freshwater Fish	Chronic	Fathead minnow	NOAEC = 9.1 ppb	0.2[b]	<1
	Freshwater Invertebrate	Chronic	Daphnia magna	NOAEC = 86 ppb	0.5[b]	<1
Exposure Conditions	Organism	Exposure Type	Most Sensitive Species (Surrogate)	Toxicity	EEC	Risk Quotient (EEC/Toxicity)

Immediately following the second application.	Freshwater Fish	Acute	Rainbow Trout	LC_{50}= 2300 ppb	1062	0.46 (LOC exceeded)
	Freshwater Invertebrate	Acute	Daphnia magna	EC_{50}= 1200 ppb	1062	0.89 (LOC exceeded)
	Freshwater Invertebrate	Chronic	Daphnia magna	NOAEC = 86 ppb	407[b]	4.7 (LOC exceeded)
	Freshwater Fish	Chronic	Fathead minnow	NOAEC = 9.1 ppb	169[b]	18.6 (LOC exceeded)

[a] The EEC of propanil at the time of normal paddy flood water release.
[b] The chronic EEC used for fish is the 56-day average and the for invertebrates is the 21-day average.
[c] The EEC of propanil in the rice paddy immediately following the second application.

b. Risk to Estuarine and Marine Animals

EFED does not expect estuarine and marine fish and invertebrates to naturally inhabit rice paddies. However, EFED expects estuarine and marine fish and invertebrates which inhabit areas adjacent to rice paddies to be exposed to propanil when flood waters are released from the rice paddies. Therefore, EFED only calculated RQs based on propanil concentrations expected at the time of flood release from the rice paddy (Table 8). The risk qoutients indicate that the level of concern is not expected to be exceeded for estuarine and marine fish and invertebrates inhabiting areas adjacent to the paddies. Currently, EFED does not have any chronic data available to access the chronic risk to estuarine and marine fish and invertebrates.

Table 8 . Acute Toxicity Values and Risk Quotients for Aquatic Organisms

Organism	Exposure Type	Most Sensitive Species (Surrogate)	Toxicity	Acute EEC*	Risk Quotient (EEC/Toxicity)
Estuarine/Marine Fish	Acute	Sheepshead minnow	LC_{50} = 4600 ppb	1.4	< 0.05
Estuarine/Marine Invertebrate	Acute	Mysid shrimp	LC_{50}= 400 ppb	1.4	< 0.05

* The acute EEC is based on the maximum expected concentration.

c. Risk to Aquatic Plants

Propanil is intended to control weed activity within rice paddies. Therefore, EFED only calculated the risks to nontarget aquatic plants inhabiting areas adjacent to the propanil treated rice paddies. Thus, the RQ calculations are based on the EEC of propanil at the time of normal paddy water release. The risk quotients indicate that the LOC is not exceeded for risk to aquatic plants inhabiting areas adjacent to rice paddies treated with propanil (Table 9).

Table 9 . Acute Risk Quotients for Aquatic Plants						
Aquatic Plant Type	Most Sensitive Species	EC_{50} (ppb)	EC_{05} (ppm)	EEC[1] (ppb)	Acute RQ[2]	Endangered RQ[3]
Vascular	Duckweed	110	0.02	1.4	<1	<1
Nonvascular	Freshwater Diatom	16	0.0063	1.4	<1	<1

[1] The maximum EEC of propanil at the time of normal paddy water release.
[2] The acute RQ is calculated as EEC/EC_{50}.
[3] The Endangered Species RQ is calculated as EEC/EC_{05} or EEC/NOAEC value.

V. Rice Use: Terrestrial Hazard, Exposure, and Risk Summary for Birds and Mammals

a. Hazard Summary

Propanil is classified as: 1) moderately toxic to avian species on an acute oral basis 2) slightly toxic to practically nontoxic to avian species on a subacute dietary basis, and 3) slightly toxic to small mammals on an acute oral basis (See Appendix H, Tables 1-3).

b. Exposure to Birds and Mammals

The terrestrial estimated environmental concentrations (EECs) for the proposed use were calculated using the spread sheet model ELLFATE (Table 10). The EECs generated by ELLFATE were used to calculate the risks to birds and mammals. ELLFATE is a spreadsheet-based model that calculates the decay of a chemical applied to foliar surfaces for single or multiple applications (See Appendix G for model inputs and assumptions). The model uses the same principle as the batch code models, FATE and TERREEC, for calculation of terrestrial estimated exposure concentrations on plant surfaces following application.

Table 10. Estimated Environmental Concentrations for Exposure to Terrestrial Wildlife (Birds and Mammals).

Site, Appl. Method	Appl. Rate (lbs. ai/A)/# of Appl./Frequency of Appl.(days)	Terrestrial EEC (ppm)			
		Short Grass (ppm) max*	Tall Grass (ppm) max*	Broadleaf Plants & Small Insects max*	Fruit & Large Insects max*
Rice	4/2/21	1593	730.29	896.27	99.59

*Value (max concentration) used to calculate acute and chronic risk quotients.
The default half-life of 35 days was used to calculate EEC values since data indicating half-lives on plant residues was not available.

b. Risks to Birds and Mammals

The risks from the proposed use to birds and mammals are assessed using risk qoutients (RQs). RQs are a function of the EECs generated by ELLFATE and the toxicity values for the most sensitive surrogate species of birds and mammals (See Table 9 for EECs and Appendix H, Tables 1-3 for Toxicity Data).

1. Risks to Birds

The use of propanil on rice is expected to exceed the level of concern for acute risk to birds (risk includes endangered species; Table 11). Currently, EFED does not have chronic toxicity data on propanil for birds. Therefore, EFED can not assess chronic risk to birds from propanil use.

Table 11. Avian Acute Risk Quotients for Multiple Application of Propanil Based on a Bobwhite quail *(Colinus virginianus)* LC_{50} of 2311 ppm..

Site	App. Rate (lbs ai/A)	Food Items	Maximum EEC (ppm)	LC50 (ppm)	Acute RQ (EEC/LC_{50})
Rice	4	Short grass	1,593	2311	0.69*
		Tall grass	730	2311	0.32*
		Broadleaf plants/Insects	896	2311	0.39*
		Seeds	100	2311	< 0.1

*The level of concern has been exceeded for risk to birds including endangered species.

2. Risk to Mammals

The proposed use of propanil on rice is expected to exceed the level of concern for acute and chronic risks to mammals (risks include endangered species; Table 12).

Table 12. Acute and Chronic RQ calculations for mammals based the rat acute oral									
Site	App. Rate (lbs ai/A)	Food Items	Maximum EEC[1] (ppm)	Acute Toxicity LD50 (mg/kg)	Acute RQ for 15 gm. mammal (EEC/ LD50)	Acute RQ for 35 gm. mammal (EEC/ LD50)	Acute RQ for 1000 gm. mammal (EEC/ LD50)	Chronic Toxicity NOAEL (ppm)	Chronic Risk Qoutient based on food item
Rice	4	Short grass	1,593	1080	**1.40**	**0.97**	**0.22**	300	**5.31**
		Broadleaf plants	730	1080	**0.64**	**0.45**	**0.10**	300	**2.43**
		Insects	896	1080	**0.79**	**0.55**	**0.12**	300	**2.99**
		Seeds	100	1080	< 0.1	<0.1	<0.1	300	< 1

RQs in bold print signify an exceedance of the level of concern for risk to mammals. The level of concern for acute risk to mammals including endangered species is 0.1. The level of concern for chronic risk to mammals including endangered species is 1.

VI. Risk to Beneficial Insects from Use on Rice

Since propanil is practically nontoxic to the honeybee ; the propanil rice use is predicted to not to exceed any level of concern for risk to nontarget insects (See Appendix H, Table 12).

VII. Rice Use: Terrestrial Exposure and Risk Summary for Terrestrial Plants

EFED assesses risk to non-target terrestrial plants as a result of propanil use on rice by the amount of drift that occurs from application. The EC_{25} value of the most sensitive species in the vegetative vigor study is compared to the drift exposure to determine the acute risk quotient due to drift. Since the guideline (123-1) requirement for vegetative vigor is not fulfilled for propanil (MRID 43069901 invalid study), the vegetative vigor risk quotient could not be determined. Acceptable data for the 123-1 study are required so that EFED can conduct a complete risk assessment for propanil. Since the non-target plant study needed to assess risks to such organisms is invalid, EFED assumes risk to non-target terrestrial plants from propanil use on rice due to its herbicidal mode of action and the reported incident on plant damage following propanil use in an adjacent area (see Appendix A for reported incident of damage to plants).

VIII. Risk to Endangered Species from Rice Usage

The use of propanil on rice is expected to present risks to endangered species of birds (acute and chronic risks), mammals (acute and chronic risks), nontarget plants, and freshwater invertebrates and fish (acute and chronic risks).

An analysis regarding the overlap of individual species and their behavior with each use site is required prior to determining the likelihood of potential impact to listed species. The Fish and Wildlife Service has not done a biological opinion for propanil.

The Agency is currently engaged in a Proactive Conservation Review with FWS and the National Marine Fisheries Service under section 7(a)(1) of the Endangered Species Act to clarify and develop consistent processes for endangered species risk assessments and consultations. Subsequent to the completion of this process, the Agency will assess those species likely to be exposed to propanil to determine the need for a consultation. The Agency will also consider regulatory changes recommended in the RED when we undertake this assessment.

IX. Aquatic Hazard, Exposure, and Risk Assessment for Propanil Use on Small Grain and Turf

A. Hazard Summary

Propanil is categorized as slightly to moderately toxic to freshwater fish and moderately toxic to freshwater invertebrates. In addition propanil is moderately toxic to estuarine/marine fish and moderately toxic to highly toxic to estuarine/marine invertebrates (Appendix H; Tables 4-9)

B. Aquatic Exposure Summary

For terrestrial crops, EFED calculates EECs using the GENeric Expected Environmental Concentration Program (GENEEC, version 2.0). The EECs are used for assessing acute and chronic risks to aquatic organisms (Table 13). Acute risk assessments are performed using peak EEC values for single and multiple applications. Chronic risk assessments are performed using the 21-day EECs for invertebrates and 60-day EECs for fish.

Table 13. Tier I upper tenth percentile EEC's (ppb) in Surface Water for the Small Grain (spring wheat, barley, oats) and Turf Uses of Propanil using GENEEC 2.0

Crop	Application rate (lbs ai/A)	Maximum ($\mu g \cdot L^{-1}$)	4 Day ($\mu g \cdot L^{-1}$)	21 Day ($\mu g \cdot L^{-1}$)	60 Day ($\mu g \cdot L^{-1}$)
Small Grains	2.25	48.9	45.1	28.2	13.0
Turf	10	217	200	125	57.8

C. Risk Assessment Summary

a. Risk to Freshwater Fish and Invertebrates

The risk quotients calculated for the small grain use (Table 14) indicate that the level of concern (LOC) is exceeded on an chronic basis for freshwater fish and invertebrates. The risk quotients for the small grain indicate that the LOCs are not exceeded on an acute basis for freshwater fish and invertebrates. The risk quotients calculated for the turf use (Table 15) indicate that the level of concern (LOC) is exceeded on an chronic basis for freshwater fish and invertebrates, and on an acute basis for freshwater fish and invertebrates (including endangered species).

Table 14. Propanil Use on Small Grains: Toxicity Values and Risk Quotients for Freshwater Fish and Invertebrates.

Organism	Exposure Type	Most Sensitive Species (Surrogate)	Toxicity	Acute EEC (ppb)	Chronic EEC[1] (ppb)	Risk Quotient (EEC/ Toxicity)
Freshwater Fish	Acute	Rainbow trout	LC_{50}= 2300 ppb	48.8	—	<0.05
	Chronic	Fathead minnow	NOAEC = 9.1 ppb	—	13.0	1.4[2]
Freshwater Invertebrates	Acute	*Daphnia magna*	EC_{50}= 1200 ppb	48.8	—	<0.05
	Chronic	*Daphnia magna*	NOAEC = 86 ppb	—	28.2	<1

1 The chronic EEC used for fish is the 60-day average and the for invertebrates is the 21-day average.
2 RQ exceeds the LOC including endangered species

Table 15. Propanil Use on Turf: Toxicity Values and Risk Quotients for Freshwater Fish and Invertebrates.

Organism	Exposure Type	Most Sensitive Species (Surrogate)	Toxicity	Acute EEC (ppb)	Chronic EEC[1] (ppb)	Risk Quotient (EEC/ Toxicity)
Freshwater Fish	Acute	Rainbow trout	LC_{50}= 2300 ppb	217	—	0.09[2]
	Chronic	Fathead minnow	NOAEC = 9.1 ppb	—	57.8	6.3[2]
Freshwater Invertebrates	Acute	*Daphnia magna*	EC_{50}= 1200 ppb	217	—	0.2[2]
	Chronic	*Daphnia magna*	NOAEC = 86 ppb	—	125	1.4[2]

1 The chronic EEC used for fish is the 60-day average and the for invertebrates is the 21-day average.
2 RQ exceeds the LOC including endangered species

b. Risk to Estuarine and Marine Animals

For the small grain use, the risk quotients (Table16) indicate that the level of concern for acute risk (LOC) is exceeded only for endangered estuarine/marine invertebrates. The risk quotients calculated for the turf use indicate that the level of concern (LOC) for acute risk is exceeded for estuarine/marine invertebrates and fish (including endangered species) (Table16). There are no data to assess chronic risk to estuarine invertebrates and fish.

Table 16. Propanil Uses on Small Grains and Turf: Acute Toxicity Values and Risk Quotients for Aquatic Organisms

Organism	Most Sensitive Species	Toxicity	Acute EEC (ppb)[1]	Risk Quotient (EEC/Toxicity)
Estuarine/ Marine Fish	Sheepshead minnow	LC_{50} = 4600 ppb	Grains: 48.8	<0.05
			Turf: 217	0.05[2]
Estuarine/ Marine Invertebrates	Mysid shrimp	LC_{50}= 400 ppb	Grains: 48.8	0.12[2]
			Turf: 217	0.54[2]

1 The acute EEC is based on the maximum expected concentration.
2 RQ exceeds the LOC including endangered species concern.

c. Risk to Aquatic Plants

The risk quotients calculated for the use on turf and small grains indicate that the LOC is exceeded for risk to aquatic nonvascular and vascular plants (including endangered species) (Table17).

Table 17. Propanil Uses on Small Grains and Turf: Acute Risk Quotients for Aquatic Plants

Aquatic Plant Type	Most Sensitive Species	EC_{50} (ppb)	EC_{05} (ppm)	EEC (ppb)	Acute RQ[1]	Endangered RQ[2]
Vascular	Duckweed	110	0.02	Grains: 48.8	<1	2
				Turf: 217	2 [3]	11 [3]
Nonvascular	Freshwater Diatom	16	0.0063	Grains: 48.8	3 [3]	8 [3]
				Turf: 217	14 [3]	34 [3]

[1] The acute RQ is calculated as EEC/EC_{50}.
[2] The Endangered Species RQ is calculated as EEC/EC_{05} or EEC/NOAEC value.
[3] RQ exceeds the LOC including endangered species concern.

X. Terrestrial Hazard, Exposure, and Risk Summary for Birds and Mammals for Small Grains and Turf Use.

a. Hazard Summary

Propanil is classified as: 1) moderately toxic to avian species on an acute oral basis 2) slightly toxic to practically nontoxic to avian species on a subacute dietary basis, and 3) slightly toxic to small mammals on an acute oral basis (see Appendix H Table 1-3).

b. Exposure to Birds and Mammals

The terrestrial estimated environmental concentrations (EECs) for the proposed use were calculated using the spread sheet model ELLFATE (Table 18). The EECs generated by ELLFATE were used to calculate the risks to birds and mammals. ELLFATE is a spreadsheet-based model that calculates the decay of a chemical applied to foliar surfaces for single or multiple applications (See Appendix G for model inputs and assumptions). The model uses the same principle as the batch code models, FATE and TERREEC, for calculation of terrestrial estimated exposure concentrations on plant surfaces following application.

Table 18. Estimated Environmental Concentrations for Exposure to Terrestrial Wildlife (Birds and Mammals).

Site, Appl. Method	Appl. Rate (lbs. ai/A)/# of Appl./Frequency of Appl.(days)	Terrestrial EEC (ppm)			
		Short Grass (ppm) max*	Tall Grass (ppm) max*	Broadleaf Plants & Small Insects max*	Fruit & Large Insects max*
Rice	4/2/21	1593	730	896	100
Small Grains	2.3/1/NA	552	253	311	35

*Value (max concentration) used to calculate acute and chronic risk quotients.
The default half-life of 35 days was used to calculate EEC values since data indicating half-lives on plant residues was not available.

b. Risks to Birds and Mammals

1. Risks to Birds

The use of propanil on small grains is expected to exceed the level of concern for acute risk to birds (risk includes endangered species) (Table 19). Toxicity data are not available to determine chronic effects of propanil use on birds. For the use on turf, the RQs indicate that the LOC is exceeded for acute risk to birds (including endangered species).

Table 19. **Small Grain and Turf Uses: Avian Acute Risk Quotients for Multiple Application of Propanil Based on a Bobwhite quail *(Colinus virginianus)* LC_{50} of 2311 ppm.**				
Site	**App. Rate (lbs ai/A)**	**Food Items**	**Maximum EEC (ppm)**	**Acute RQ (EEC/LC50)**
Turf	10	Short grass	2,400	1
		Tallgrass	1,100	0.5
		Broadleaf Plants/Insects	1,350	0.6
		Seeds	150	<0.1
Small Grains: Oats, Barley, Spring Wheat	2.3	Short grass	552	0.2[a]
		Tallgrass	253	0.1[b]
		Broadleaf Plants/Insects	311	0.1[b]
		Seeds	35	<0.1

a The level of concern is exceeded for risk to restricted use and endangered birds.
b The LOC is exceeded for risk to birds to endangered species.

2. Risk to Mammals

The labeled use of propanil on turf is expected to exceed the level of concern for acute and chronic risks to mammals (risks include endangered species) (Table 20). For the use on small grains, the RQ indicates that the LOC is expected to exceed the LOC for acute and chronic risk to small mammals.

Table 20. Turf and Small Grain Uses: Acute and Chronic RQ calculations for mammals based the rat acute oral LD50 of 1080 mg/kg and a chronic NOAEL of 300 mg/kg.							
Site	App. Rate (lbsai/A)	Food Item	Maximum EEC[1] (ppm)	Acute RQ for 15 g mammal (EEC/LD50)	Acute RQ for 35 g mammal (EEC/LD50)	Acute RQ for 1000 g mammal (EEC/LD50)	ChronicRQ based on food item
Turf	10	Short grass	2,400	2	1.5	0.33	8
		Broadleaf plants	1,100	0.97	0.67	0.15[a]	4
		Insects	1,350	1	0.83	0.19	5
		Seeds	150	<0.1	<0.1	<0.1	0.5
Small Grains: Oats, Barley, and Spring Wheat	2.25	Short grass	552	0.49	0.34[a]	<0.1	1.8
		Broadleaf plants	253	0.22[a]	0.15[b]	<0.1	<1
		Insects	311	0.27[a]	0.19[a]	<0.1	1
		Seeds	35	<0.1	<0.1	<0.1	<1

1 The default half-life of 35 days was used to calculate EEC values since data indicating half-lives on plant residues was not available.
Note:
Acute RQ = EEC (ppm)/LD50 (mg/kg) • % Body Weight Consumed
Chronic RQ= EEC (ppm)/ NOAEL (ppm)
a The LOC is exceeded for mammals including endangered species.

XI. Risk to Beneficial Insects from Small Grain and Turf Uses

Since propanil is practically nontoxic to the honeybee , the labeled use is predicted to pose minimal risk to nontarget insects (See Appendix H, Table H13).

XII. Small and Turf Terrestrial Exposure and Risk Summary for Terrestrial Plants

EFED assesses risk to non-target terrestrial plants from use on rice based on the determination of the amount of drift that occurs from application. The EC_{25} value of the most sensitive species in the vegetative vigor study is compared to the drift exposure to determine the acute risk quotient due to drift. Since the guideline (123-1) requirement for vegetative vigor is not fulfilled for propanil (MRID 43069901 invalid study), the vegetative vigor risk quotient could not be determined. Acceptable data for the 123-1 study are required so that EFED can conduct a complete risk assessment for propanil.

To determine risk to non-target terrestrial plants from terrestrial uses other than rice, the EC_{25} value for the most sensitive species in the seedling emergence study is compared to runoff and drift exposure to determine the risk quotient (EEC/Toxicity Value).

The EECs and acute risk quotients for terrestrial and semi-aquatic plants were based on the maximum label use for turf (single application of 10 lbs ai/A) and small grains (oats, barley, spring wheat; single application of 2.3 lbs ai/A).

Based on a single application (ground and aerial) of propanil to turf at 10 lbs ai/A, the plant LOCs (acute risk and endangered species concern) are exceeded (RQ >1) for plants inhabiting semi-aquatic areas and terrestrial areas (Tables 20 and 21). Based on a single application (ground or aerial) of propanil to small grains at 2.3 lbs ai/A, the plant LOCs are only exceeded for endangered plants which inhabit semi-aquatic areas (Table 21 and 22).

Currently, EFED does not perform chronic risk assessments for terrestrial and semi-aquatic plants.

Table 21. Terrestrial and Semi-Aquatic Plant Risk Quotients

Acute Risk Quotients from a Single Application for Plants Inhabiting Terrestrial and Semi-Aquatic Areas Based on a (onion = most sensitive plant species) Seedling Emergence EC_{25} of 1.4

Site, Application Method & Rate (lbs ai/A)	Seedling Emergence EC_{25} (lbs ai/A)	Total Loading to Adjacent Area (SheetRunoff+Drift) (lbs ai/A)	Total Loading to Semi-aquatic Area (Channelized Runoff+ Drift) (lbs ai/A)	Emergence RQ Terrestrial Plants (sheet)[a]	Emergence RQ Semi-Aquatic Plants (channel)[b]
Turf, Un-incorporated Ground 10	1.4	0.6	5.1	<1	3.6
Turf, Aerial 10	1.4	0.8	3.5	<1	2.5
Small Grains, Un-incorporated Ground 2.3	1.4	0.14	1.2	<1	<1
Small Grains, Aerial 2.3	1.4	0.18	0.81	<1	<1

[a] Emergence RQ for Terrestrial Plants = Total Loading to adjacent area ÷ Seedling Emergence EC_{25}
[b] Emergence RQ for Semi-Aquatic Plants = Total Loading to Semi-Aquatic Area ÷ Seedling Emergence EC_{25}

Table 22. Terrestrial Plant Risk Quotients - Endangered Species

Acute Endangered Species Risk Quotients from a Single Application for Plants Inhabiting Terrestrial and Semi-Aquatic Areas Based on an (onion) Seedling Emergence NOAEC of 0.61

Site, Application Method & Rate (lbs ai/A)	Seedling Emergence NOAEC (lbs ai/A)	Total Loading to Adjacent Area (SheetRunoff+Drift) (lbs ai/A)	Total Loading to Semi-aquatic Area (Channelized Runoff+ Drift) (lbs ai/A)	Emergence RQ Terrestrial Plants (sheet)[a]	Emergence RQ Semi-Aquatic Plants (channel)[b]
Turf, Un-incorporated Ground 10	0.61	0.6	5.1	1.0	8.4
Turf, Aerial 10	0.61	0.8	3.5	1.3	5.7
Small Grains, Un-incorporated 2.3	0.61	0.14	1.2	<1	2
Small Grains, Aerial 2.3	0.61	0.18	0.81	<1	1.3

[a] Emergence RQ for Terrestrial Plants = Total Loading to adjacent area ÷ Seedling Emergence NOAEC
[b] Emergence RQ for Semi-Aquatic Plants = Total Loading to semi-Aquatic Area ÷ Seedling Emergence NOAEC

XIII Risk to Endangered Species From Small Grain and Turf

The preliminary risk assessment for endangered species indicates that propanil exceeds the endangered species LOCs for the following uses on turf and small grain: 1)acute risks to birds and small mammals for turf and small grains; 2)chronic risks to small mammals for turf; 3) risk to terrestrial plants and aquatic plants for turf and small grains; and 4) acute and chronic risks to freshwater fish and invertebrates, and acute estuarine fish and invertebrates for turf; chronic risks to freshwater fish and acute estuarine invertebrates for small grains.

Although propanil is only slightly toxic to birds and mammals, the LOC exceedences for these endangered animals is based on multiple applications or high rates of applications and a 35-day half-life value in the exposure analysis. Although the endangered species LOC for estuarine invertebrates has been exceeded, there are no listed species in this group.

Further analysis regarding the overlap of individual species and their behavior with each use site is required prior to determining the likelihood of potential impact to listed species. The Fish and Wildlife Service has not done a biological opinion for propanil.

The Agency is currently engaged in a Proactive Conservation Review with FWS and the National Marine Fisheries Service under section 7(a)(1) of the Endangered Species Act to clarify and develop consistent processes for endangered species risk assessments and consultations. Subsequent to the completion of this process, the Agency will assess those species likely to be exposed to propanil to determine the need for a consultation. The Agency will also consider regulatory changes recommended in the RED when we undertake this assessment.

APPENDIX A

Reported Incident

There is one incident report associated with damage to nontarget plants by spray drift of propanil applied to rice. Following application of propanil to 150 acres of rice in Craighead, Arkansas, shade trees in the adjacent areas shortly showed moderate to severe injury in their leaves. Symptoms included burnt and shedding leaves and lack of new growth on older trees. An analysis was not conducted, but due to the proximity of the aerial propanil application to the trees, the official report ruled that propanil was likely the cause of the tree injury.

APPENDIX B
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APPENDIX C
ENVIRONMENTAL FATA DATA

TABLE C1. SUMMARY OF SUBMITTED ENVIRONMENTAL FATE STUDIES AND THEIR STATUS

Guideline #	MRID	Status*	Data Requirement status**
161-1	41066601	A	S
161-2	41070701	A	S
161-3	42820401	C	S (sufficient information for fate assessment)
162-1	41537801	A	S
162-3	41872601	A	S
162-4	41872601	A	S
163-1	42780401	A	S
164-2	42200401 42200501	A	S

*:Study Status Codes: A=Acceptable U=Ungradable C=Ancillary I=Invalid.
**:Data Requirement Status Codes: S=Satisfied P=Partially satisfied N=Not satisfied R=Reserved W=Waived.

The following is a summary the environmental fate studies of propanil.

Degradation

161-1 **Hydrolysis.** MRID 41066601. Propanil was stable to hydrolysis in buffered, sterilized solutions at pH 5 after 32 days at 25±1 °C in the dark. Propanil was shown to be stable to hydrolysis at pH 7, and 9 and reported in the Registration Standard issued in 1987 (Acc# 00111395).

161-2 **Photodegradation in Water.** MRID 41070701. Uniformly ring-labeled ^{14}C-propanil degraded in water with half-life of 103.3 days after exposure to natural light for 30 days at 24±0.3°C (half-life of 737.2 days in the dark). Major degradates were unknown polar compounds which reached a maximum of 16.9% at day 30. 3,4-DCA accounted for 0.7% at day 15. CO_2 accounted for 2.7% of applied radioactivity by day 30.

161-3 **Photodegradation in Soil.** MRID 42820401. Uniformly ring-labeled ^{14}C-propanil did not degrade in air-dried sandy loam soil irradiated on a 12-hour photo period with a Xenon arc lamp at 23-245°C for 30 days. Propanil degraded in a moist soil with a half-life of 11 days (2 days in the dark) indicating that degradation is due to microbial metabolism and not photolysis. This study provides only qualitative information. However, since results suggest that "photolysis" is largely due to metabolism by microbes, little information would be gained by requiring additional study.

162-1 Aerobic Soil Metabolism. MRID 41537801. ^{14}C-propanil degraded with a half-life of 0.5 days in a non-sterilized aerobic sandy loam soil that was incubated in darkness at 25±1°C for one year. The major degradate identified was 3,4-dichloroaniline (3,4-DCA) with a half-life of 30 days. 3,4-DCA accounted for up to 43.7% of the applied radioactivity at day 2 postapplication. –hydroxy-3,4-dichloroazobenzene (DCAB)accounted for up to 10% at day 0.5. $^{14}CO_2$ comprised 11.2% of the applied radioactivity by 365 days posttreatment.

162-3 Anaerobic Aquatic Metabolism. MRID 41872601. ^{14}C-propanil rapidly metabolized in anaerobic rice paddy water and sediment (half-life 2-3 days) to form the major degradate (3,4-DCA). Decline in 3,4-DCA concentration was observed post day 14 sampling. By day 91, 30% of radioactivity was unidentified polar material.

162-4 Aerobic Aquatic Metabolism. MRIDs 41848701, 41872601. ^{14}C-propanil rapidly metabolized in anaerobic rice paddy water and sediment (half-life 2 days) to form the major degradate (3,4-DCA). 3,4-DCA formation reached a maximum at day 7 postapplication (accounted for 77% of applied radioactivity); in water 37%, and in sediment 40%. No detectable 3,4-dichloroazobenzene (DCNB) or N-hydroxy-3,4-dichloroazobenzene (DCAB) were observed in this study.

Mobility

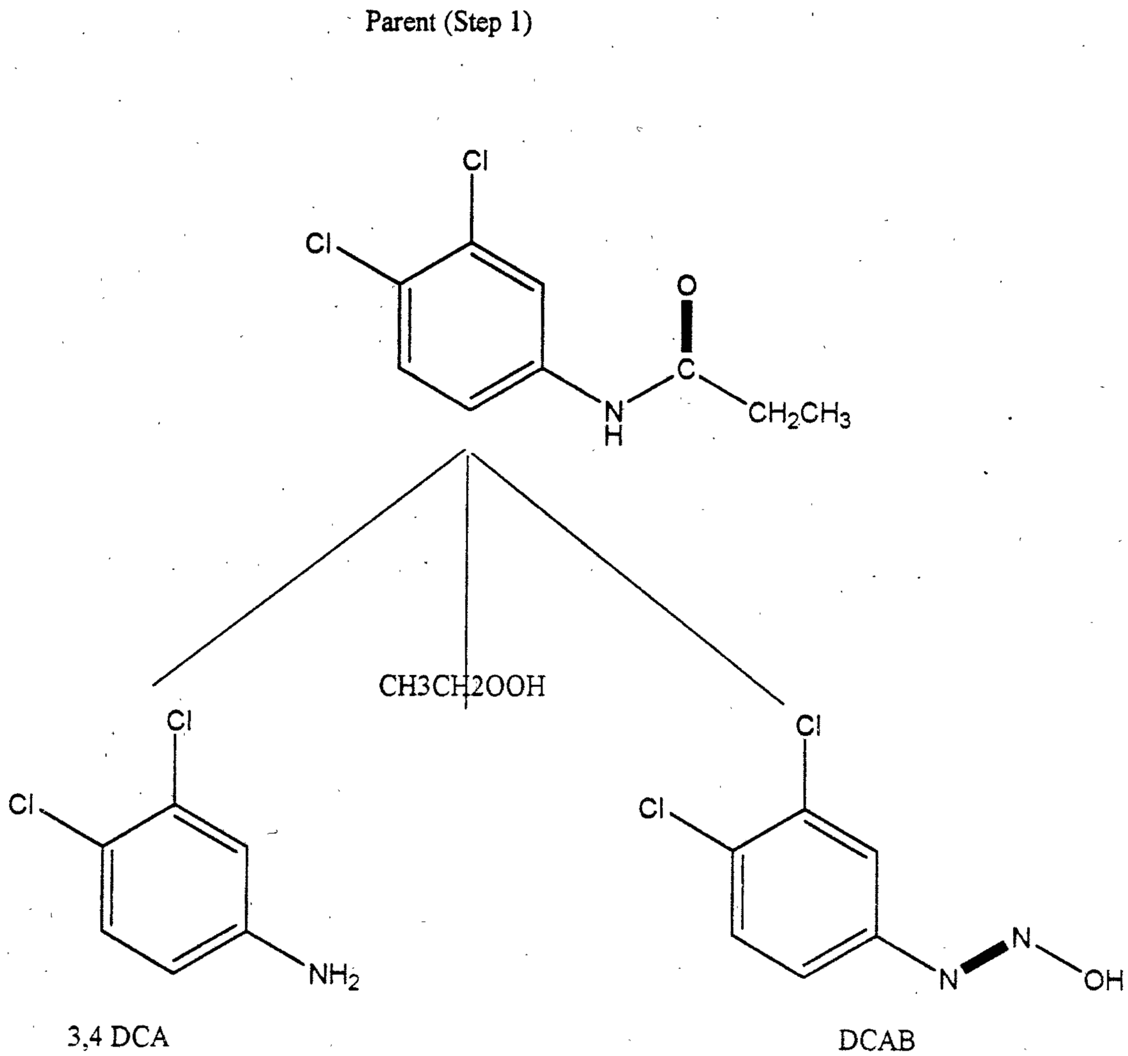
163-1 Leaching/Adsorption/Desorption. MRID 42780401. The adsorption and desorption of ^{14}C-propanil was studied in five soils using batch equilibrium. Results of the study suggest that propanil is in the medium mobility class for sand, sandy loam, and clay loam soils, and has a low affinity for mobility in silty clay loam and silt loam soils (ASTM, 1996). The adsorption coefficient (K_d) for sand, sandy loam, silty clay loam, silt loam and clay loam were 0.538, 2.32, 5.79, 8.0, and 11.7, respectively. The corresponding K_{oc} values were 306, 239, 703, 800, and 389, respectively.

Field Dissipation

164-2 Aquatic Field Dissipation. MRID 42200401. STAM —4 was applied twice to a rice paddies in Arkansas at a rate of 4 lb ai/acre. The dissipation half-life of propanil in soil was calculated to be 1.48 days. Parent propanil was not detected in paddy or outflow water at any sampling interval, or in soil cores taken 164 days after the second application. Propanil concentration reached a peak (2.33±0.45 ppm) in soil (sediment) on the day of the second application and remained high for the next 2 days; the concentration had fallen to close to quantification limits (0.01 ppm) by 14 days after the second application. Solvent extractable 3,4-DCA reached a peak value (2.70 ppm) in the 0-2 inch soil layer on the day after the second application. The average concentrations of 3,4-DCA in that layer ranged from 0.64-1.46 ppm for the next seven days. The calculated half-life of 3,4-DCA in paddy water was 3.12 days.

164-2 Aquatic Field Dissipation. MRID 42200501. Propanil 4 was applied twice to a rice paddies in Louisiana at a the rate of 4 lb ai/acre. The dissipation half-life of propanil in soil was calculated to be 1.29 days. Parent propanil was detected in paddy or outflow water only on the days of application. Propanil concentration reached a peak (1.0 ppm) in soil (sediment) on the day of the first application and had fallen to close to quantitation limits (0.01 ppm). Propanil concentration in paddy water was highest on the day of the second application (2.3 ppm). Solvent extractable 3,4-DCA reached a peak value (0.74 ppm) in the 0-2 inch soil layer five days after the second application. The average concentrations of 3,4-DCA in that layer were close to quantitation limits for 120 days. The calculated half-life of 3,4-DCA in paddy water was 2.05 days.

Figure C1. The proposed metabolic pathway of propanil in aerobic soil



APPENDIX D
ECOLOGICAL EFFECTS DATA REQUIREMENTS

Table D1. Summary of ecological effects data requirements for propanil

Guideline #	Data Requirement	MRID #	Classification	Is data requirement satisfied?
71-1a	Avian acute oral LD_{50} bobwhite quail	41361001	Core	Yes
71-2a 71-2b	Avian subacute dietary LC_{50} bobwhite quail mallard duck	41361101 41360701 Acc. No. 246413 Acc. No. 246087	Core	Yes
71-4a 71-4b	Avian reproduction bobwhite quail mallard duck	Not Submitted	NA	No
72-1a 72-1c	Freshwater fish acute LC_{50} rainbow trout bluegill sunfish	41360201 41359801 40098001 Acc. No. 246087 Acc. No. 249347	Core	Yes
72-2a	Freshwater invertebrate acute LC_{50} (daphnia)	41776801 Acc. No. 249347	Core	Yes
72-3a	Estuarine/marine fish acute LC_{50} (sheepshead minnow)	41776001	Core	Yes
72-3b	Estuarine/marine acute invertebrateEC_{50} (mysid)	41776901	Core	Yes
72-3c	Estuarine/marine acute invertebrate EC_{50} (mollusc)	41777101 42253100	Core	Yes
72-4a	Freshwater fish early life stage (fathead minnow)	41776501 42259601 42475301 Acc. No. 095187	Core	Yes
72-4c	Freshwater invertebrate life cycle (daphnia)	41776601 42145601	Core	Yes
72-5	Freshwater fish full life cycle (fathead minnow)			
81-1[2]	Acute mammalian oral LD50 (rat)	41360801	Core	Yes
83-5[2]	Three-generation mammalian reproduction (rat)	00036091	Core	Yes
123-1	Tier II Vegetative Vigor Seedling Emergence& Seed Germination	43069901	Core for Seed Germination and Seedling Emergence Invalid for Vegetative vigor	No

Table D1. Summary of ecological effects data requirements for propanil				
Guideline #	Data Requirement	MRID #	Classification	Is data requirement satisfied?
123-2	Aquatic plant acute EC50 (Tier II)	41777201 41777301 41777401 41777501 41777601	Core	Yes
141-1	Bee Acute Test	00018842	Core	Yes

APPENDIX E
SURFACE WATER AND GROUNDWATER MODELING DATA

1. Surface Water

Estimated Environmental Concentrations in unfinished (ambient) Drinking Water for use of Propanil on Rice

This Appendix provides Estimated Environmental Concentrations (EECs) in unfinished (ambient) surface waters used as a source of drinking water numbers, for the use of Propanil on rice.

Propanil is to be applied to rice paddies no more than two times per year, at a maximum use rate of 4 lb ai/A/application. Applications are to be at least 21 days apart, and may be to dry or flooded paddies. The application is 4487 g/ha for both the first and second applications.

The Environmental Fate and Effects Division has no officially approved model to predict concentrations of pesticides in rice paddy water. The approach taken here was based on a hypothetical rice paddy, 1 hectare in size, flooded to a depth of 10 cm, with a sediment interaction zone of 1cm. Based on these dimensions, there are one million liters of water and 100 cubic meters of active sediment in the paddy. The sediment is assumed to weigh 135,000 kg based on a bulk density of 1.35 g/cc.

EEC Calculation for Propanil in Wet-Seeded Rice

The calculation steps for propanil EECs in wet-seeded rice paddies are as follows:

1) Calculate initial concentration (Ci) of chemical based on application rate and water volume in paddy.

$$Ci = 4487 \text{ g} \div 10^6 \text{ L} = 4.49 \text{ mg/L}$$

2) Calculate concentration in sediment (Cs) based on soil-water partition coefficient, Kd. $Cs = Ci \times Kd$.
Silty clay loam Kd = 5.79 L/kg (MRID 42780401)

$$Cs = 5.79 \text{ L/kg} \times 4.49 \text{ mg/L} = 26.0 \text{ mg/kg}$$

3) Calculate mass of chemical in sediment (Ms) from Cs and mass of sediment. $Ms = Cs \times 135{,}000$ kg.

$$Ms = 26.0 \text{ mg/kg} \times 135000 \text{ kg} = 3510 \text{ g}$$

4) Subtract mass of chemical in sediment (Ms) from initial mass of chemical applied to paddy. Divide by volume of water in paddy to get concentration in water (Cw) on day 0.

$Cw = (4487g - 3510\ g) \div 10^6\ L = 977\ \mu g/L$

5) Calculate decay of chemical in paddy water according to first-order decay equation using aerobic aquatic metabolism half-life (2 days × 3 = 6 days; MRIDs 41848701, 41848601) as the rate constant, k. $k = \ln 2/2 = 0.116$/day. $Cw,t = (Cw,0) \times \exp(-0.116)(t)$. Repeat steps 1 to 5 for second application, and sum up resulting concentration for each day. Follow decay to 78 days (90 days from planting).

Table E1. Results for Wet-Seeded Rice. (First application on day 0 is 2 weeks after seeding.)

Day	Application 1	Application 2	Sum (ppb)
0	977	—	977
1	870	—	870
4	614	—	614
10	306	—	306
21	85	977	1062
28	38	433	471 **(peak Gulf Coast DW = 236 ppb)**
56	1.5	17	18.5
78	0.11	1.3	1.4 **(peak CA DW = 0.7 ppb)**

EEC Calculation for Propanil in Dry-Seeded Rice

For dry seeded rice, the first application is assumed to be to dry paddies (1 cm of active sediment, 135000 kg), and the second application occurs 21 days later, and permanent flooding is on the 22nd day. The second application is degraded in the manner as for wet-seeded rice.

The chemical is decayed in soil with a half-life of 1.5 days ($k = 1.04$/day) for 21 days. The second application is on day 21 and is decayed at the aerobic aquatic rate, $k = 0.116$/day.

The calculation steps for propanil EECs in dry-seeded rice paddies are as follows:

1) Calculate concentration of chemical in soil (Cs) based on application rate and mass of soil (135,000 kg).

$Cs = 4487\ g \div 135000\ kg = 33.24\ mg/kg$

2) Decay chemical in soil according to aerobic soil metabolism rate (0.5 days × 3 = 1.5 days; MRID 41537801) as the rate constant, k. $k = \ln 2/1.5 = 1.04/day$. Follow the decay to 21 days. Calculate the mass of chemical in soil left at 21 days from Cs at 21 days and the mass of soil. Partition this mass between the soil and the flood water.

3) Make the second application, and partition between water and sediment. Add the mass partitioning from the soil. Flood the paddy, and decay according to aerobic aquatic rate. Follow to 78 days (90 days from planting).

Table E2. Results for Dry-Seeded Rice. (days 0-21 follow aerobic soil metabolism degradation rate, k = 1.04/day) (days 21-78 follow aerobic aquatic metabolism degradation rate, k = 0.116/day)

Day	Application 1	Application 2	Sum
0	33.24	—	33.24 mg/kg
1	11.7	—	11.7 mg/kg
3	1.5	—	1.5 mg/kg
6	0.065	—	0.065 mg/kg
10	0	—	0
21	0	977	977 ppb **(peak MS Valley DW = 489 ppb)**
22	—	870	870 ppb
56	—	17	17 ppb
78	—	1.3	1.3 ppb **(normal release DW = 0.65ppb)**

Drinking Water Calculation

The expected drinking water concentration is based on the Index Reservoir in Shipman, Illinois. This is a 144,000 m^3 reservoir in a 172-hectare watershed. Based on the default Percent Cropped Area (PCA) factor of 0.87, we assumed that there would be a maximum of 150 hectares of rice paddies in the watershed. We assumed release of all 150,000 m^3 of paddy water into the reservoir on day 78 in California (i.e., normal release 90 days from planting), day 28 for the Gulf Coast (simulating a large storm 40 days after planting) and on day 43 in the Mississippi Valley, simulating a normal draining of the paddies.

The peak DW concentration is then the concentration of the paddy on the day of release divided by two, since the volume of the reservoir and the volume of the paddies are roughly equal. A chronic concentration was obtained by decaying the peak concentration for a year at the aerobic aquatic rate, and taking the average over 365 days.

Aquatic Exposure Calculation

To determine exposure to aquatic organisms, two separate/different EECs were calculated for each of the wet- and dry-seeded rice scenarios as follows:

(1) EECs were determined beginning with the expected concentrations of the pesticide in the rice paddy immediately following the second application. This concentration was decayed using the aerobic aquatic degradation rate. This value estimates the worst-case expected environmental exposure concentration for aquatic organisms inhabiting and/or frequenting the rice paddy water

(2) EECs were determined based on the concentration expected (4 ppb for both rice scenarios) at the time of normal paddy flood water release under typical rice cultural practices. This concentration was decayed and average water concentrations were calculated as previously described in (1).

Inputs

Soil aerobic half-life: 1.5 days × 3 = 1.5 days (k = 1.04/day). (MRID 41537801)
for 3,4-DCA: 30 days × 3

Aquatic aerobic half-life for total residues: 2 days × 3 = 6 days (k = 0.116/day). (MRIDs 41848701, 41848601)
for 3,4-DCA: 5 days × 3

Silty clay loam soil-water partition coefficient (Kd) = 5.79 L/kg. (MRID 42780401)
for 3,4-DCA: 5.79 L/kg

Rice paddies 10 cm deep with 1 cm sediment interaction zone. Volume of water: 1000 m^3 (1,000,000 L) per hectare.

Volume of sediment: 100 m^3 per hectare. Mass of sediment: 135,000 kg at bulk density of 1.35 g/cc.

Volume of Index Reservoir: 144,000 m^3. Area of Index Reservoir watershed: 172 hectares. Area of watershed in rice paddies (default percent cropped area = 0.87) = 150 hectares. Volume of water in 150 ha rice paddies 10 cm deep = 150,000 m^3 (roughly 1 Index Reservoir volume)

Application scenario

First application 4487 g/ha at 2 weeks after seeding or emergence.
Second application 4487 g/ha at a 21-day application interval.

For dry-seeded rice, permanent flood is 1 day after second application.

For 3,4-DCA application rate: The maximum maount of 3,4-DCA formed in an aerobic soil metabolism study of propanil (MRID 41537801) is approximately 43.7% of the applied propanil. The maximum amount of 3,4-DCA formed in an aerobic aquatic metabolism study of propanil (MRID 41848701) was 77% of the applied propanil. Therefore, a conservation application rate of 3,4-DCA was estimated based on (1) the maximum application rate of propanil, (2) the maximum formation of 3,4-DCA from propanil (ie. 0.437 or 0.77), and (3) the molecular weight ratio of 3,4-DCA to propanil for mass balance on molar basis (ie. 0.74). The application rates used for input were 1.3 and 2.3 lb ai/A depending on soil or aquatic degradation scenarios, respectively.

Release Scenario

California (wet-seeded): day 90 (78 days after first application, same as normal release time).
Gulf Coast (wet-seeded): day 40 (28 days after first application).
Mississippi Valley (dry-seeded): day 43 (10 days after second application).

Results (Drinking Water)

Propanil

The peak drinking water concentrations for the Gulf Coast and California are 236 and 0.7 ppb, respectively, as shown in the Wet-Seeded Results Table E1. The resulting chronic concentrations (annual averages in Index Reservoir) are 5.9 and 0.02 ppb, respectively.

The peak drinking water concentration for the Mississippi Valley is 489 ppb, as shown in the Dry-Seeded Results Table E2. The chronic, annual average is 12.2 ppb. If the (normal) release is on day 78 (90 days from seeding), the peak is 0.65 ppb and the annual average 0.02 ppb.

3,4-dichloroaniline

The peak drinking water concentrations for the Gulf Coast and California are 1007 and 106 ppb, respectively, as shown in Table E3. The resulting chronic concentrations (annual averages in Index Reservoir) are 59 and 6.2 ppb, respectively.

The peak drinking water concentration for the Mississippi Valley is 1022 ppb, as shown in the Dry-Seeded Results Table E2. The chronic, annual average is 60 ppb. If the (normal) release is on day 78 (90 days from seeding), the peak is 118 ppb and the annual average 6.9 ppb.

Table E3. Modeled EECs (ppb) of Propanil and 3,4-DCA in Surface **DRINKING** Water from two applications to three different rice-growing scenarios.

Scenario	Acute (peak)		Chronic	
	Propanil	**3,4-DCA**	**Propanil**	**3,4-DCA**
California	0.7	106	0.02	6.2
Gulf Coast	236	1007	5.9	59
Mississippi Valley (flooded release; day 21)	489	1022	12.2	60
Mississippi Valley (normal release; day 78)	0.65	118	0.02	6.9

Results (Aquatic Exposure)

Table E4. Modeled EECs (ppb) of Propanil for **AQUATIC** Exposure from two applications to three different rice-growing scenarios.

Cultural Practice	Maximum	4-Day	21-Day	56-Day
Wet-seeded Rice (CA & Gulf Coast regions)[1]	1062	854	407	169
Dry-seeded Rice (MS Valley region)	977	785	374	156

1 Reported EECs are the maximum from the results from the CA and Gulf Coast modeled scenarios.

Table E5. Modeled EECs (ppb) of Propanil for AQUATIC Exposure at the time of normal flood release (90 days after planting).

Cultural Practice	Maximum	4-Day	21-Day	56-Day
Wet- and Dry-seeded Rice	1.4	1.1	0.5	0.2

EEC Calculations for Aquatic Organism Exposure to Propanil from Small Grains and Turf Uses

EFED used modeling to assess aquatic exposure. EFED calculated EECs for the small grains (barley, oats, spring wheat) and turf uses using the GENeric Expected Environmental Concentration Program (GENEEC). The EECs are used for assessing acute and chronic risks to aquatic organisms. Acute risk assessments are performed using peak EEC values for single and multiple applications. Chronic risk assessments are performed using the 21-day EECs for invertebrates and 56-day EECs for fish.

Table E6. Estimated Environmental Concentrations (EECs) For Propanil Aquatic Exposure.

Site	Application Rate (lbs ai/A)	Initial (PEAK) EEC (ppb)	21-day average EEC (ppb)	60-day average EEC (ppb)
Turf	10	217	125	58
Small Grains (Oats, Barley, Spring Wheat)	2.25	49	28	13

Limitations of to GENEEC Modeling

A single 10 hectare field with a 1 hectare pond does not reflect the dynamics in a watershed large enough to support a drinking water facility. A basin of this size would likely not be planted completely to a single crop nor be completely treated with a pesticide. Additionally, treatment with the pesticide would likely occur over several days or weeks, rather than all on a single day. This would reduce the magnitude of the concentration peaks, but also make them broader, reducing the acute exposure but perhaps increasing the chronic exposure. The fact that the simulated pond has no outlet is also a limitation as water bodies in this size range would have at least some flow through (rivers) or turnover (reservoirs). In spite of these limitations, a Tier I EEC can provide a reasonable upper bound on the concentration found in drinking water if not an accurate assessment of the true concentration. The EEC'S have been calculated so that in any given year, there is a 10% probability that the maximum average concentration of that duration in that year will equal or exceed the EEC at the site. Risk assessment using Tier I values can capably be used as refined screens to demonstrate that the risk is below the level of concern.

GENEEC Outputs

```
RUN No.   1 FOR Propanil       ON   small grains    * INPUT VALUES *
--------------------------------------------------------------------
RATE (#/AC)  No.APPS &  SOIL  SOLUBIL   APPL TYPE  NO-SPRAY INCORP
 ONE(MULT)   INTERVAL    Kd   (PPM )   (%DRIFT)  ZONE(FT)  (IN)
```

```
------------------------------------------------------------
2.250( 2.250)  1  1     2.3  225.0   AERL_B( 13.0)   .0   .0

FIELD AND STANDARD POND HALFLIFE VALUES (DAYS)
------------------------------------------------------------
METABOLIC  DAYS UNTIL  HYDROLYSIS  PHOTOLYSIS  METABOLIC  COMBINED
(FIELD)  RAIN/RUNOFF  (POND)    (POND-EFF)   (POND)    (POND)
------------------------------------------------------------
 1.50       2        N/A      .00-    .00    6.00     6.00

GENERIC EECs (IN MICROGRAMS/LITER (PPB))    Version 2.0 May 1, 2001
------------------------------------------------------------
 PEAK      MAX 4 DAY    MAX 21 DAY    MAX 60 DAY    MAX 90 DAY
 GEEC      AVG GEEC     AVG GEEC      AVG GEEC      AVG GEEC
------------------------------------------------------------
 48.86      45.08        28.15         13.03          8.84


RUN No.   2 FOR Propanil        ON   TURF     * INPUT VALUES *
------------------------------------------------------------
RATE (#/AC)  No.APPS &  SOIL  SOLUBIL  APPL TYPE  NO-SPRAY INCORP
ONE(MULT)    INTERVAL    Kd   (PPM )   (%DRIFT)  ZONE(FT)  (IN)
------------------------------------------------------------
10.000( 10.000)  1  1    2.3  225.0   AERL_B( 13.0)   .0   .0

FIELD AND STANDARD POND HALFLIFE VALUES (DAYS)
------------------------------------------------------------
METABOLIC  DAYS UNTIL  HYDROLYSIS  PHOTOLYSIS  METABOLIC  COMBINED
(FIELD)  RAIN/RUNOFF  (POND)    (POND-EFF)   (POND)    (POND)
------------------------------------------------------------
 1.50       2        N/A      .00-    .00    6.00     6.00

GENERIC EECs (IN MICROGRAMS/LITER (PPB))    Version 2.0 May 1, 2001
------------------------------------------------------------
 PEAK      MAX 4 DAY    MAX 21 DAY    MAX 60 DAY    MAX 90 DAY
 GEEC      AVG GEEC     AVG GEEC      AVG GEEC      AVG GEEC
------------------------------------------------------------
 216.83     200.03       124.91        57.80         39.25
```

2. Ground Water

The SCIGROW (Screening Concentrations In Ground Water) model is used to provide a ground water screening concentration which is an estimate of likely ground water concentrations if the pesticide is used at the maximum use rate allowed by the label in areas where ground water is exceptionally vulnerable to contamination. In most cases, a majority of the use areas will have ground water that is less vulnerable to contamination than the areas used to derive the SCIGROW estimate. The estimated ground water concentration resulting from the SCIGROW modeling is shown in Table E7. Based on the modeling, propanil is not expected to reach ground water. The input values used in the ground water model, SCIGROW, are listed in Table E8.

Table E7. Groundwater Screening Concentrations[a] for Propanil and 3,4-DCA using SCIGROW2.

Crop	Application Rate (lbs ai/A)	Groundwater Screening Concentration (ppb)[a]
Rice (highest use rate)	4	≤0.001
	1.3[b]	0.35

[a] These concentrations are the screening concentrations for acute, chronic, and cancer risks.

[b] The maximum maount of 3,4-DCA formed in an aerobic soil metabolism study of propanil (MRID 41537801) is approximately 43.7% of the applied propanil; therefore, a conservation application rate of 3,4-DCA was estimated based on (1) the maximum application rate of propanil, (2) the maximum formation of 3,4-DCA from propanil (ie. 0.437), and (3) the molecular weight ratio of 3,4-DCA to propanil for mass balance on molar basis (ie. 0.74).

Table E8. Ground Water Exposure Inputs for SCIGROW for Propanil residues

MODEL INPUT VARIABLE	INPUT VALUE	COMMENTS
Application Rate (lbs. ai/A)	4 (rice)	Maximum use rate on product label
Maximum No. of Applications	2 (rice)	Maximum number of applications on the label
K_{oc} (ml/g)	239	Lowest non-sand K_{oc} was used (MRID 42780401)
Aerobic Soil Metabolic Half-life (days)	0.5	Half-life in sandy loam soil (MRID 41537801)

Table E9. Ground Water Exposure Inputs for SCIGROW for 3,4-DCA residues

MODEL INPUT VARIABLE	INPUT VALUE	COMMENTS
Application Rate (lbs. ai/A)	1.3 (rice)[a]	Maximum use rate on product label
Maximum No. of Applications	2 (rice)	Maximum number of applications on the label

K_{oc} (ml/g)	239	Lowest non-sand K_{oc} for propanil was used (MRID 42780401); Input parameter guidance.
Aerobic Soil Metabolic Half-life (days)	30	Half-life in sandy loam soil (MRID 41537801)

[a] The maximum maount of 3,4-DCA formed in an aerobic soil metabolism study of propanil (MRID 41537801) is approximately 43.7% of the applied propanil; therefore, a conservation application rate of 3,4-DCA was estimated based on (1) the maximum application rate of propanil, (2) the maximum formation of 3,4-DCA from propanil (ie. 0.437), and (3) the molecular weight ratio of 3,4-DCA to propanil for mass balance on molar basis (ie. 0.74).

SCIGROW Output

SCIGROW Output for Propanil use on Rice

```
RUN No.  1 FOR propanil          INPUT VALUES
--------------------------------------------------------------------
APPL (#/AC) APPL. URATE   SOIL   SOIL AEROBIC
RATE       NO. (#/AC/YR) KOC  METABOLISM (DAYS)
--------------------------------------------------------------------
  4.000    2    8.000    239.0     0.5


GROUND-WATER SCREENING CONCENTRATIONS IN PPB
--------------------------------------------------------
           .00123
--------------------------------------------------------
A=    .250 B=  244.000 C=   -.602 D=    2.387 RILP=   -1.437
F=  -3.118 G=     .001 URATE=   8.000 GWSC=      .006100
```

SCIGROW Output for 3,4-DCA

```
RUN No.  1 FOR 3,4-DCA          INPUT VALUES
--------------------------------------------------------------------
APPL (#/AC) APPL. URATE   SOIL   SOIL AEROBIC
RATE       NO. (#/AC/YR) KOC  METABOLISM (DAYS)
--------------------------------------------------------------------
  1.300    2    2.600    239.0     30


GROUND-WATER SCREENING CONCENTRATIONS IN PPB
--------------------------------------------------------
           .354092
```

A= 85.000 B= 244.000 C= 1.929 D= 2.387 RILP= 3.111
F= -.343 G= .454 URATE= 2.600 GWSC= 1.180124

Appendix F
Terrestrial and Semi-Aquatic Plants

Terrestrial plants inhabiting dry and semi-aquatic areas may be exposed to pesticides from runoff, spray drift or volatilization. Semi-aquatic areas are low-lying wet areas that may dry up at times throughout the year. EFED's runoff scenerio is (1) based on a pesticide's water solubility and the amount of pesticide present on the soil surface and its top one inch, (2) characterized as "sheet runoff" (one treated acre to an adjacent acre) for dry areas, (3) characterized as "channelized runoff" (10 acres to a distant low-lying acre) for semi-aquatic areas, and (4) based on percent runoff values of 0.1, 0.02, and 0.05 for water solubilities of <10, 10-100, and >100 ppm, respectively.

The following formulas were used to calculate EECs for *terrestrial plants* inhabiting areas adjacent to treatment sites:

Un-incorporated ground application:

Sheet Runoff	=	maximum application rate (lbs ai/A) × runoff value
Drift	=	maximum application rate × 0.01
Total Loading	=	sheet runoff (lbs ai/acre) + drift (lbs ai/A)

Aerial application:

Sheet Runoff	=	maximum application rate (lbs ai/A) × 0.6 (60% application efficiency) × runoff value
Drift	=	maximum application rate (lbs ai/A) × 0.05
Total Loading	=	sheet runoff (lbs ai/A) + drift (lbs ai/A)

The following formulas were used to calculate EECs for *semi-aquatic plants* inhabiting areas adjacent to treatment sites:

Un-incorporated ground application:

Channelized Runoff	=	maximum application rate (lbs ai/A) × runoff value × 10 acres
Drift	=	maximum application rate (lbs ai/A) × 0.01
Total Loading	=	channelized runoff (lbs ai/A) + drift (lbs ai/A)

Aerial application:

Channelized Runoff	=	maximum application rate (lbs ai/acre) × 0.6 (60% application efficiency) × runoff value × 10 acres
Drift	=	maximum application rate (lbs ai/A) × 0.05
Total Loading	=	channelized runoff (lbs ai/A) + drift (lbs ai/A)

APPENDIX G

Assumptions and Inputs of Terrestrial Exposure Residues "ELL-Fate" Model (Version 1.2)
(Developed by Laurence Libelo. February, 1999)

This spreadsheet based model calculates the decay of a chemical applied to foliar surfaces for single or multiple applications. It uses the same principle as the batch code models FATE and TERREEC for calculating terrestrial estimates exposure (TEEC) concentrations on plant surfaces following application.

A first order decay assumption is used to determine the concentration at each day after initial application based on the concentration resulting from the initial and additional applications. The decay is calculated by from the first order rate equation:

CT = Cie-kT

or in integrated form:

ln (CT/Ci) = kT

Where

CT = concentration at time T = day zero.

Ci = concentration, in parts per million (PPM) present initially (on day zero) on the surfaces. Ci is calculated based on Kenaga and Fletcher by multiplying the Ci is calculated based on the Kenaga nomogram (Hoerger and Kenaga, (1972) as modified Fletcher (1994). For maximum concentration the application rate, in pounds active ingredient per acre, is multiplied by 240 for Short Grass, 110 for Tall Grass, and 135 for Broad leafed plants/insects and 15 for Seeds, 35 for Broad leafed plants/insects. Additional applications are converted from pounds active ingredient per acre to PPM on the plant surface and the additional mass added to the mass of the chemical still present on the surfaces on the day of application.

k = degradation rate constant determined from studies of hydrolysis, photolysis, microbial degradation etc. Since degradation rate is generally reported in terms of half-life the rate constant is calculated from the input half-life (k = ln 2/T1/2) instead of being input directly. Choosing which processes controls the degradation rate and which half-life to use in terrestrial exposure calculations is open for debate and should be done by a qualified scientist.

T = time, in days, since the start of the simulation. The initial application is on day 0. The simulation is hardwired to run for 365 days.

The program calculates concentration on each type of surface on a daily interval for one year. The maximum concentration during the year and the average concentration during the first 56 days are calculated.

The inputs used to calculate the amount of the chemical present are in highlighted in yellow on the spread sheet. Outputs are in blue. The inputs required are:

Application Rate: The maximum label application rate (in pounds ai/acre)
Half-life: The degradation half-life for the dominate process(in days)
Frequency of Application: The interval between repeated applications, from the label (in days)
Maximum # Application per year: From the label.

The calculated concentrations are used to calculate Avian and Mammalian RQ values. The maximum calculated concentration is divided by user input values of Chronic No Observable Adverse Effects Level and acute LC50 to give RQs for each type of plant surface.

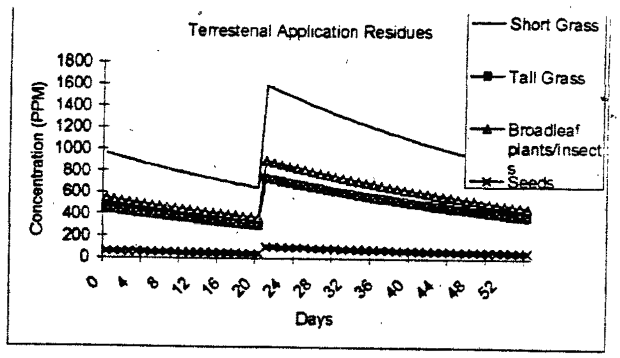
The rat LC 50 is calculated by dividing the mammalian LD 50 by 0.05 (to correct for actual food consumption)

For 15g, 35g and 1000 g mammals the RQ values are calculated by dividing the maximum concentration for each surface by the LD 50 or NOAEL corrected for consumption (0.95, 0.66 and .15 body wt. for herbivores and) insectivores and 0.21, 0.15 and 0.3 body wt. for granivore). The number of days that the input value of Chronic No Observable Adverse Effects Level and acute LC50 are exceeded in the first 56 days is calculated by comparing the input value to the calculated concentration.

A graph of concentration on each plant surface vs time is plotted and a "level of concern" line can be added at a user specified level.

The maximum single application which can be applied and not exceed the toxicity input values if calculated by dividing the input value by the Kenaga maximum concentration for Short Grass (240).

Chemical Name: Propanil
Use Rice
Formulation Technical



Inputs

Application Rate	4	lbs a.i./acre
Half-life	35	days
Frequency of Application	21	days
Maximum # Apps./Year	2	

Outputs

	Maximum Concentration (PPM)	56 day Average Concentration (PPM)
Short Grass	1593.36	1022.84
Tall Grass	730.29	468.85
Broadleaf plants/insects	896.27	575.40
Seeds	98.59	63.93

Avian

		# days Exceeded on short grass (in first 56)
Acute LC50 (ppm)	2311	0
Chronic NOAEC (ppm)		

	Acute RQ	Chronic RQ (Max. res mult. apps.)
Short Grass	0.69	#DIV/0!
Tall Grass	0.32	#DIV/0!
Broadleaf plants/insects	0.39	#DIV/0!
Seeds	0.04	#DIV/0!

days Exceeded on short grass (in first 56)

Max Single Application which does NOT exceed

Avian Acute	9.829	
Avian Chronic	0.000	(lb a.i.)
Mammalian Acute	30.00	
Mammalian Chronic	1.25	

Mammalian

		# days Exceeded on short grass (in first 56)
Acute LD50 (mg/kg)	1080	20
Chronic NOAEL (mg/kg)	300	56

Rat Calculated LC50 (ppm) 21600

	15 g mammal Acute RQ (mult apps)	35 g mammal Acute RQ (mult apps)	1000 g mammal Acute RQ (mult. apps)	Rat Acute Dietary RQ	Rat Chronic Dietary RQ
Short Grass	1.40	0.97	0.22	0.07	5.31
Broadleaf plants/ insects	0.64	0.45	0.10	0.03	2.43
Large Insects	0.79	0.55	0.12	0.04	2.99
Seeds (granivore)	0.02	0.01	0.00	0.00	0.33

Length of Simulation 1 year
Level of Concern [illegible] (ppm)

APPENDIX H

ECOLOGICAL EFFECTS CHARACTERIZATION

Toxicity to Terrestrial Animals

Avian Acute Oral Toxicity

Since the LD_{50} value is between 51 to 500 mg/kg (Table H1), propanil is classified as moderately toxic to upland gamebird species on an acute oral basis. The acute avian oral toxicity data requirement (Guideline 71-1a) is fulfilled (MRID 41361001).

Table H1. Acute oral toxicity of Propanil to Northern bobwhite quail.

Species	% ai	LD_{50} (mg/kg)	Toxicity Category	MRID No. Author/Year	Study Classification
Northern bobwhite quail *(Colinus virginianus)*	97.6	201	Moderately toxic	41361001 Grimes/1989	Core

[1]Core (study satisfies guideline). Supplemental (study is scientifically sound, but does not satisfy guideline)

Avian Subacute DietaryToxicity

Since the LC_{50} values fall within the range of 2861ppm to >5000 ppm (Table H2), propanil is classified as slightly toxic to practically nontoxic to avian species on a subacute dietary basis. The subacute dietary study requirement (Guideline 71-2a,b) is fulfilled (MRIDs 41361101, 41360701 and Acc. Nos. 246413, 246087).

Table H2. Subacute dietary toxicity of Propanil to Northern bobwhite quail and mallard ducks.

Species	% AI	8-Day LC_{50} (ppm)[1]	Toxicity Category	MRID or Acc. No. Author/Year	Study Classification
Bobwhite quail *(Colinus virginianus)*	97.6	2861	Slightly Toxic	41361101 Grimes/1989	Core
Bobwhite quail *(Colinus virginianus)*	88	2311	Slightly toxic	Acc. 246413 Piccirillo/1981	Core
Mallard duck *(Anas platyrhynchos)*	97.6	5627	Practically Non-toxic	41360701 Grimes/1989	Core
Mallard duck *(Anas platyrhynchos)*	88	>5000	Practically Non-toxic	Acc. 246087 Piccirillo/1981	Core

[1]Test organisms observed an additional three days while on untreated feed.

Avian Chronic

An avian reproduction study has not been submitted; therefore, the data requirements have not been fulfilled (Guideline 71-4a).

Mammal, acute and chronic

Based on the available data (Table H3), propanil is slightly toxic to small mammals on an acute oral basis with an LD_{50} of 1080 mg/kg.

Table H3. Mammalian toxicity data for rats exposed to Propanil.

Species/Study Type	% ai	Test Type	Toxicity Value (mg/kg)	Affected Endpoints	MRID No.	Classification
laboratory rat *(Rattus norvegicus)*/acute	100 %	Acute Oral	1080 (LD50)	Mortality	41360801	Core
laboratory rat *(Rattus norvegicus)*/chronic	100%	3 Generation Reproducti on	300 (NOEAL)	Reproduction	00036091	Core

Toxicity to Freshwater Aquatic Animals

Freshwater Fish, Acute

Since the TGAI LC_{50} for freshwater fish ranges from 5.4 ppm to 12.8 ppm, the TGAI of propanil is categorized as slightly to moderately toxic to freshwater fish on an acute basis (Table H4). The formulated product is classified as slightly toxic since the LC_{50} values lie in the range of 12.8 to 14 ppm.. The guideline requirement (72-1) is fulfilled (MRIDs 41360201, 41359801, 40098001, and Acc. Nos. 246087, 249347).

Table H4. Acute Toxicity of Propanil to Freshwater Fish.

Species	% AI	96-hour LC_{50} (ppm)	Toxicity Category	MRID or Acc. No. Author/Year	Study Classification
Rainbow trout (*Oncorhynchus mykiss*)	44	12.8	Slightly Toxic	41360201 Richie/1989	Core
Rainbow trout	88	2.3	Moderately Toxic	Acc. 246087 LeBlanc/1980	Core

Table H4. Acute Toxicity of Propanil to Freshwater Fish.

Species	% AI	96-hour LC_{50} (ppm)	Toxicity Category	MRID or Acc. No. Author/Year	Study Classification
Bluegill sunfish (*Lepomis macrochirus*)	44	14	Slightly Toxic	41359801 Ritchie/1989	Core
Bluegill sunfish	86.2	5.4	Moderately Toxic	Acc. 249347 Biospherics Inc./1982	Core
Bluegill sunfish	45	48-hour LC_{50} = 16	Slightly Toxic	Acc. No. not reported Harrison Lake National Fish Hatchery/1970	Supplemental

Freshwater Invertebrates, Acute

A freshwater aquatic invertebrate toxicity test using the TGAI is required to establish the toxicity of propanil to aquatic invertebrates. The preferred test species is *Daphnia magna*. Results indicate that propanil is moderately toxic to freshwater invertebrates (Table H5). The guideline requirement (72-2a) for propanil is fulfilled (MRID No. 41776801 and Acc. No. 249347).

Table H5. Freshwater Invertebrate Acute Toxicity for Propanil

Species	% AI	48-hour EC_{50} (ppm)	Toxicity Category	MRID or Acc. No. Author/Year	Study Classification
Water flea (*Daphnia magna)*	44	1.2	Moderately Toxic	41776801 Burgess/1990	Core
Water flea	36.5	LC_{50} = 11.4	Slightly Toxic	Acc. 095187 Harper&Ball/1965	Supplemental (Core for TEP)

Freshwater Fish, Chronic

Results indicate that propanil may affect fish length and survival at concentrations greater than 9.1-9.3 ppb (Table H6). The guideline requirement (72-4a) is fulfilled for propanil (MRID Nos. 41776501, 42259601, 42475301 and Acc. No. 095187).

Table H6. **Chronic Toxicity of Propanil to Freshwater Fish (Early Life-Stage Under Flow-through Conditions).**

Species	% AI	LOEC/NOEC (ppb)	Endpoints Affected	MRID or Acc. No. Author/Year	Study Classification
Fathead minnow *(Pimephales promelas)*	98	19/9.3	Survival	41776501 & 42259601 Sousa/1991	Core
Fathead minnow *(Pimephales promelas)*	98	21/9.1	Length	42475301 Dionne/1992	Core
Fathead minnow *(Pimephales promelas)*	85.4	< 24/not reported	Unknown	Acc. No. not reported EG&G Bionomics Inc./1980	Supplemental

Freshwater Invertebrate, Chronic

Results indicate that aquatic invertebrate reproduction impairment may occur at levels greater than 81 ppb (Table H7). The guideline requirement (72-4c) is fulfilled for propanil (MRID Nos. 41776601, 42145601).

Table H7. Freshwater Invertebrate Chronic Toxicity for Propanil

Species	% AI	NOEC/LOEC (ppb)	Endpoints Affected	MRID or Acc. No. Author/Year	Study Classification
Water flea *(Daphnia magna)*	98	86/160	Reproduction	41776601 & 42145601 McNamara/1991	Core

Toxicity to Estuarine and Marine Aquatic Animals

Estuarine and Marine Fish, Acute

Acute toxicity testing with estuarine/marine fish using the TGAI is required for propanil because the on rice may be associated with estaurine or marine habitats. The preferred test species is sheepshead minnow. The LC_{50} value (4.6 ppm; Table H8) indicates that propanil is moderately toxic on an acute basis to estuarine/marine fish. The guideline requirement (72-3a) has been fulfilled (MRID 41776001).

Table H8. Acute Toxicity of Propanil to Estuarine/Marine Fish.

Species	% AI	96-hour LC_{50} (ppm)	Toxicity Category	MRID or Acc. No. Author/Year	Study Classification
Sheepshead minnow/Flow-through *(Cyprinodon variegatus)*	98	4.6	Moderately Toxic	41776001 Sousa/1990	Core

Estuarine and Marine Invertebrates, Acute

Acute toxicity testing with estuarine/marine invertebrate using the TGAI is required for propanil because the use site, rice may be associated with estaurine or marine habitat. The preferred test species are mysid shrimp and eastern oyster. The EC_{50} value (4.96 ppm) for propanil indicates that the TGAI is moderately toxic on an acute basis to estuarine/marine eastern oyster (Table H9). The LC_{50} value (0.4 ppm) for propanil indicates that the TGAI is highly toxic on an acute basis to the mysid shrimp. The guideline requirement (72-3b,c) has been fulfilled (MRID Nos. 41777101, 42253100, 41776901).

Table H9. Acute Toxicity of Propanil to Estuarine/Marine Invertebrates.

Species	% AI	96-hour LC_{50}/EC_{50} (ppm)	Toxicity Category	MRID No. Author/Year	Study Classification
Eastern oyster/Flow-through (shell deposition or embryo-larvae) *(Crassostrea virginica)*	98	EC_{50} = 4.96	Moderately Toxic	41777101 & 42253100 Dionne/1990	Core
Mysid/Flow-through *(Americamysis bahia)*	98	LC_{50} = 0.4	Highly toxic	41776901 Sousa/1990	Core

Toxicity to Non-Target Plants

Terrestrial Plants

Tier II phytotoxicity tests measured the response of plants to propanil, relative to a control, and five or more test concentrations. Results from the Tier II toxicity testing on the technical/TEP material are reported in Table H10. The Tier II guideline (123-1) is not fulfilled. The vegetative vigor study is invalid (MRID 43069901) because the method of application was inadequate; the chemical treatment solutions were more dilute than what is used under actual use conditions. An acceptable vegetative vigor study is still required. The Tier II guideline (123-1) is fulfilled for seed germination and seedling emergence (MRIDs 43069901).

Table H10. Terrestrial Non-Target Plant Toxicity Data (Tier II) for Propanil.

Test of Test	%AI	Most sensitive species	EC_{25} (lb ai/A)	NOEL (lb ai/a)	MRID No. Author/Year	Study Classification
Seed Germination	97.6	onion	3.5	0.3	43069901 Christensen/1993	Core
Seedling Emergence	97.6	onion	1.4	0.61	43069901 Christensen/1993	Core
Vegetative Vigor	97.6	Invalid	Invalid	Invalid	43069901 Christensen/1993	Invalid

Table H11. Seedling Emergence Test for Propanil: Results for the most sensitive parameter[a] of each species			
Species	Parameter	EC_{25} (lbs ai/A)	NOEL (lbs ai/A)
Corn	emergence, length	>5.2	5.2
Ryegrass	shoot length	0.77[b]	0.09[b]
Oat	emergence, length	>5.2	0.61
Onion	shoot length	1.4	0.61
Cabbage	shoot length	0.72	0.23[c]
Cucumber	shoot length	4.9b[b]	2.9
Lettuce	shoot length	0.53	0.11[c]
Radish	shoot length	1.5	0.61
Soybean	shoot length	1.1	0.31
Tomato	shoot length	3.8	2.9

[a]determination of the most sensitive species is based on EC_{25} values (except for corn)
[b]based on visual interpolation
[c]based on the EC_5

Toxicity to Aquatic Plants

Aquatic plant testing is required for propanil because aerial application and outdoor non-residential aquatic use will expose non-target aquatic plants to propanil. The following species were tested at Tier II: *Lemna gibba*, *Skeletonema costatum*, *Anabaena flos-aquae*, and *Navicula pelliculosa*. These results indicate that exposure levels of propanil at 0.11 ppm or greater may cause detrimental effects to the growth and reproduction of vascular aquatic plant species (Table H12). Algae and diatoms may be affected from propanil exposure levels of 0.016 ppm or greater. The guideline requirement (123-2) is fulfilled. (MRID Nos. 41777201, 41777301, 41777401, 41777501, 41776701).

Table H12. Nontarget Aquatic Plant Toxicity (Tier II) for Propanil

Species	% AI	EC_{50}/EC_{05} (ppm)	MRID No. Author/Year	Study Classification
Vascular Plants				
Duckweed *Lemna gibba*	98	0.11	41777201 Giddings/1990	Core
Nonvascular Plants				
Marine diatom *Skeletonema costatum*	98	0.030	41777301& 41777401 Giddings/1990	Core
Freshwater diatom *Navicula pelliculosa*	98	0.016	41777501 Giddings/1990	Core
Blue-green algae *Anabaena flos-aquae*	98	0.11	41777601 Giddings/1990	Core

Insects

A honey bee acute contact study using the technical grade active ingredient (TGAI) is required for propanil because its use may result in honey bee exposure. Based on the available data, propanil, is practically non-toxic to bees (Table H13).

Table H13. Honey bee acute toxicity data

Species	% ai	Test Type	Toxicity Value (ug/bee)	MRID No.	Classification
Honey	Tech	48 hr.	> 24.17	00018842	Core